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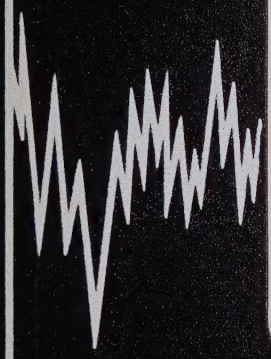
S/N 173

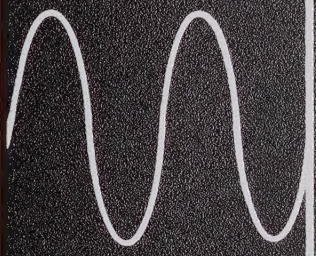
INSTRUCTION MANUAL

41015-2

SD115A

AUTOMATIC LEVEL PROGRAMMER





SPECTRAL DYNAMICS CORPORATION

SERIAL 173

SDC
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S/N 173

INSTRUCTION MANUAL

41015-2

SD115A

AUTOMATIC LEVEL PROGRAMMER

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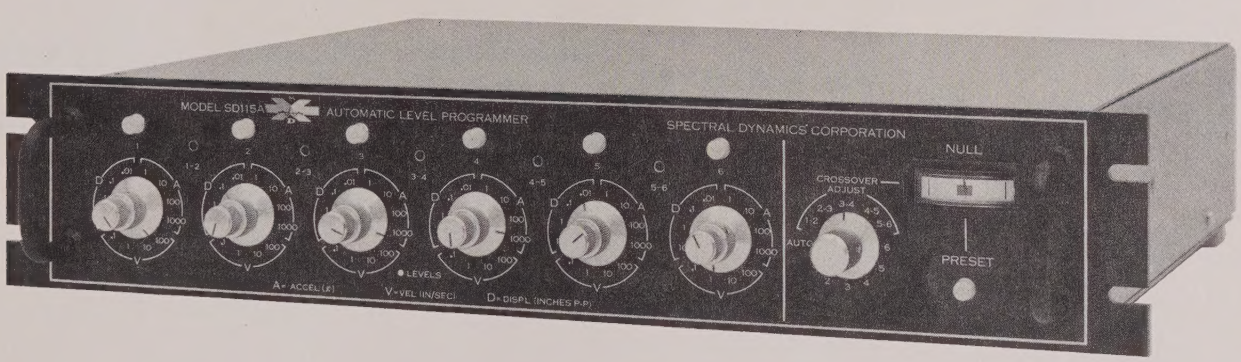

MODEL SD115A AUTOMATIC LEVEL PROGRAMMER

MANUAL CHANGES

Model: SD115A
Unit Serial: As Applicable
Manual Edition: --

Each change listed below must be individually analyzed for applicability in accordance with "Action" directed relative to unit serial number and/or documentation affected.

Change #1
ECO-1434
(3-15-73)

Effectivity: S/N 096 & on.
Action: Schematic, DWG. No. 11479(M), Sheet 1;
On circuit card A1 (A-V-D Input Assy 11206-1), Change R49 from 4.99k to 1.96k, R51 from 13k to 4.12k, R38 from 270Ω to 680Ω, and add resistor R70 (10k, 1/4W, 5%) connected from the base to the collector of Q6.

Change #2
ECO-1538
(8-27-73)

Effectivity: S/N 011 & on.
Action: Schematic, DWG. No. 11479(M), Sheet 1;
On circuit card A6 (Power Supply Assy 11420-1), Change C3 and C4 from 0.01 μF to 0.1 μF.

Change #3
ECO-1644
(12-15-73)

Effectivity: S/N 164 & on.
Action: Schematic, DWG. No. 11479(M), Sheet 1;
On circuit card A1 (A-V-D Input Assy 11206-1), Add symbol adjacent to R51.

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DWG NO. 11479 Schematic/Component Layout (3 Sheets) . . . . . Rear

RECEIVING INSPECTION PROCEDURE

The Model SD115A Automatic Level Programmer is shipped fully assembled, packed in a polystyrene case designed to protect it against all normal shipping hazards. Immediately upon receipt, inspect the exterior of the shipping case and note any visible damage. Keep all forms and invoices attached to the shipping case. Remove the instrument from the shipping case and test its functional operation in accordance with Section II of this manual. If shipping damage is apparent, file a claim with the carrier's claims agent and send a copy to Spectral Dynamics Corporation. Be sure to include the instrument name, model number, and serial number on all correspondence. Spectral Dynamics Corporation will advise the buyer what should be done; arrangements for repair or replacement will be made as applicable.

WARRANTY POLICY

All Spectral Dynamics products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain components listed in some of the operating manuals, for the specified period. We will repair or replace products which prove to be defective during the warranty period, providing the failure or damage has not been caused by misuse or abnormal operating conditions. Fuses and lamps are specifically excluded from warranty. If the malfunction or a portion thereof is determined by Spectral Dynamics Corporation to have been caused by misuse or abnormal conditions of operation, an estimate of cost to repair will be submitted to the purchaser for approval before beginning any repair work.

Liability under this warranty is limited to servicing and adjusting the instrument returned to the factory, with transportation charges prepaid by the purchaser. No other warranty is expressed or implied. We are not liable for consequential damages.

If any malfunction develops, notify Spectral Dynamics Corporation or its representative in your area, giving details of the problem, and the name, model and serial number of the equipment. Upon receipt of this information, service data or shipping instructions will be provided.

RETURN SHIPMENT PROCEDURE

On receipt of shipping instructions, forward the instrument prepaid via air freight to the factory or authorized repair station indicated on the instructions. Replace the instrument in its original shipping case, or surround with two to three inches of shock absorbing material and then pack it in a heavy-weight cardboard box, wooden box, or other strong container.

SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION

The Model SD115A Automatic Level Programmer (ALP) provides a means of programming six manually preset levels of acceleration (A), velocity (V), or displacement (D). It was specifically designed for use with a Model SD104A-5 Sweep Oscillator and Model SD105B Amplitude Servo/Monitor. Figure 1-1 shows the SD115A ALP operating in conjunction with an SD105B to control a single vibration exciter system.

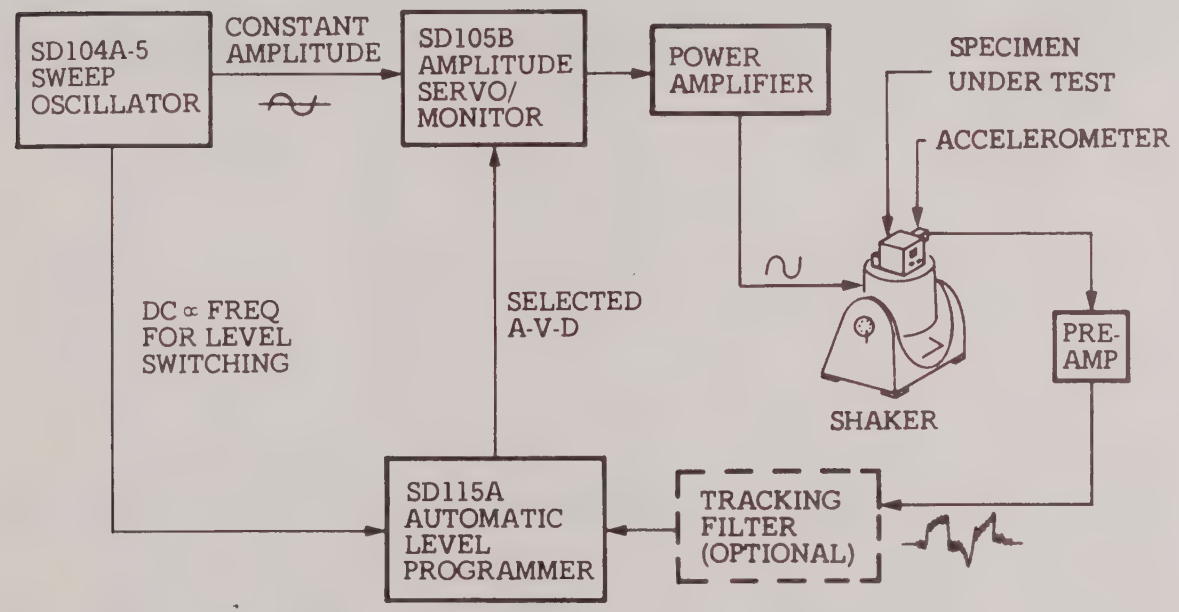
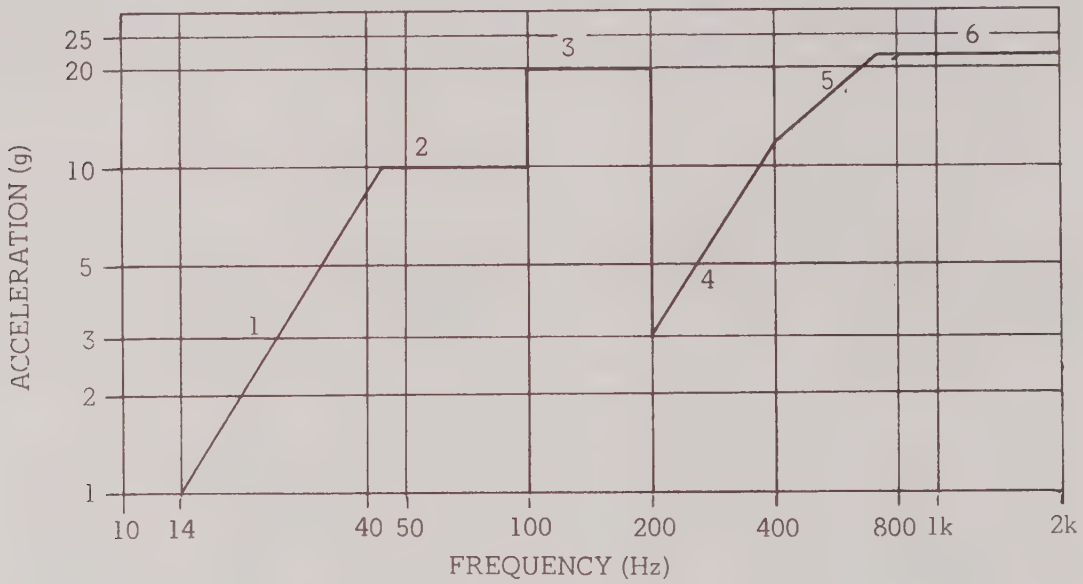


Figure 1-1. Concept of Operation

Note that the SD115A ALP is in a servo loop that comprises (in sequence) the SD105B, a power amplifier, a shaker, a specimen under test with attached accelerometer, a tracking filter (optional), and the SD115A ALP. In this setup, the following sequence of events occurs: The SD104A-5 sweeps up through the desired frequency range (5 Hz to 2 kHz for example). The sweep oscillator output is routed through the SD105B and power amplifier causing the shaker to vibrate the specimen under test. The output of the accelerometer attached to the specimen under test is applied to the SD115A ALP. (A tracking filter, Model SD101B Dynamic Analyzer, is usually employed here to provide a filtered signal output at the system excitation frequency.)

The **SD115A ALP** electronically processes the acceleration signal to produce a-c signals proportional to velocity (V) and displacement (D). The input acceleration (A) signal and the developed velocity (V) and displacement (D) signals are applied to the six front-panel A-V-D Range Switches. These switches and associated potentiometers facilitate presetting a 6-level vibration analysis program. The test level profile of a typical program is shown below.



In the program illustrated above, the preset test parameters, frequency range, and approximate crossover frequency for each level are as follows:

Level	Preset Parameter	Freq Range (Hz)	≈Crossover Freq (Hz)
1	DISPL, 0.1 in. p-p	14–44	44
2	ACCEL, 10g	44–100	100
3	ACCEL, 20g	100–200	200
4	DISPL, 0.00145 in. p-p	200–400	406
5	VEL, 1.85 in./s	400–800	734
6	ACCEL, 22g	800–2,000	------

During programming the exact crossover frequency need not be computed. A smooth transition between levels is facilitated by means of the front-panel NULL meter and associated switches and controls. This feature allows the crossover point (frequency) to be accurately set electronically, thus eliminating the possibility of a "thump".

1.2 FRONT PANEL FUNCTIONAL DESCRIPTION

Figure 1-2 illustrates the instrument front panel followed by a brief description of each of the front panel functions.

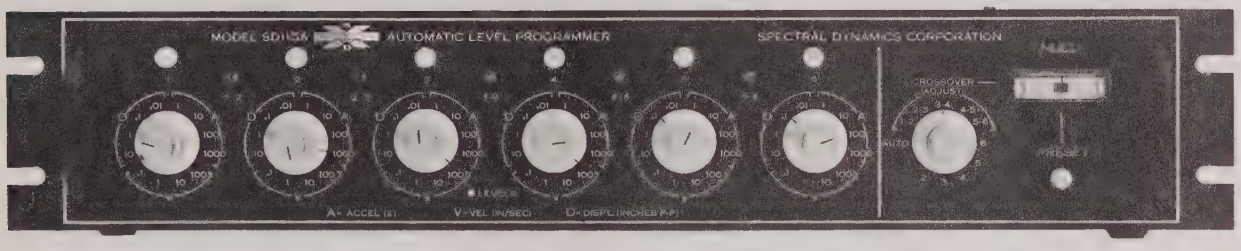


Figure 1-2. Front Panel

(1) A-V-D Indicators (1 through 6)

Light individually to indicate which A-V-D level (1 through 6) is in operation.

(2) A-V-D Range Switches/LEVEL Controls (1 through 6)

Each A-V-D range switch/LEVEL control performs the following functions:

A-V-D Range Switch

Outer (larger knob provides selection of the level range of A (acceleration) at 1, 10, 100, or 1000g; V (velocity) at .1, 1, 10, or 100 inches/second; or D (displacement) at .01, .1, 1, or 10 inches peak-to-peak.

LEVEL Controls

Center (smaller) knob varies level of A, V, or D over range selected by associated A-V-D switch.

(3) Level Crossover Adjust Potentiometer (1-2, 2-3, 3-4, 4-5, 5-6)

Used during system programming to set the crossover point (frequency) between A-V-D levels 1-6. Fewer than six levels (or five crossovers) can be programmed by turning unused higher number crossover potentiometers (5-6, 4-5, etc.) fully clockwise.

(4) Mode/PRESET LEVEL and CROSSOVER ADJUST Switch/Control

This multiple purpose switch/control performs the following functions:

Mode/PRESET LEVEL Switch (Lower Markings)

Setting determines operational mode of unit. AUTO position, used during normal operation, provides automatic selection of levels 1 through 6 as a function of system excitation frequency. Positions 1 through 6 are used during programming to set LEVEL controls for proper output as indicated on SD105B front panel ACCELERATION meter. However, any position 1 through 6 may be selected as a fixed-level operational mode.

CROSSOVER ADJUST Switch (Upper Markings)

Setting applies outputs of selected levels (1 and 2, 2 and 3, 3 and 4, etc.) to NULL meter circuit during programming of crossover points. (See Level Crossover Adjust Potentiometers described above.)

(5) NULL Meter

Facilitates setting exact crossover point between levels when calibrating and programming the SD115A.

(6) PRESET Indicator

Lights to indicate SD105B and SD115A are in PRESET mode ready for level calibration and programming. OUTPUT control/switch on SD105B is set to PRESET detent (extreme CCW position). A calibration voltage (PRESET OUT from a Model SD105A-CLP or a Model SD105B) is applied to all A-V-D LEVEL controls (described above).

1.3 REAR CHASSIS FUNCTIONAL DESCRIPTION

Figure 1-3 illustrates the rear of the instrument chassis followed by a brief description of each of the input/output functions.

Figure 1-3. Rear Chassis

BYPASS/NORMAL Switch

BYPASS

ACCEL NO. 1 and NO. 2 INPUTS are connected directly to their respective ACCEL NO. 1 and NO. 2 OUTPUTS for application to the SD105B, also, all SD115A interlock circuitry is shunted and lamp circuits are disabled. SD115A is in standby condition.

NORMAL

ACCEL NO. 1 INPUT is used and processed to provide programmed levels of A, V, or D at ACCEL NO. 2 OUTPUT and corresponding reference levels at ACCEL NO. 1 OUTPUT. ACCEL NO. 2 INPUT is not used (open circuit).

INPUTS

ACCEL NO. 1 (J1)

Accepts control accelerometer output signal.

ACCEL NO. 2 (J2)

Facilitates connection of a second monitor or control accelerometer to the SD105B ACCEL NO. 2 INPUT when SD115A BYPASS/NORMAL switch is set to BYPASS.

–DC ∝ FREQ (J3)

Accepts the negative d-c voltage proportional to frequency from SD104A-5; this voltage controls the automatic high-pass filters in the input integrators during a normal swept-frequency operation.

DC ∝ LOG FREQ (J4)

Accepts the d-c voltage proportional to log frequency from SD104A-5; this voltage controls the automatic level switching circuits during a normal swept-frequency operation.

PRESET (J5)

Accepts PRESET sine wave signal from a Model SD105A-CLP or a Model SD105B; this signal replaces accelerometer input during calibration and programming procedure.

OUTPUTS

ACCEL NO. 1 (J6)

Connected to **SD105B** ACCEL NO. 1 INPUT; provides 50g reference levels for programmed A-V-D levels at ACCEL NO. 2 OUTPUT described below.

ACCEL NO. 2 (J7)

Connected to **SD105B** ACCEL NO. 2 INPUT; provides up to six programmed A-V-D levels for controlling a vibration exciter system.

AUX FUNCTIONS (J8)

Provides interconnections to SD104A-5 and **SD105B** for interlock circuitry and various intercontrol functions required during preset level calibration and programming.

230/115 Switch

Facilitates changeover of primary power input circuit for either 230V or 115V operation. Proper input power to be applied shows in window; screwdriver blade slot is up for 115V operation and down for 230V operation.

POWER IN

Accepts 3-wire plug and cable (supplied) for applying 115/230 Vac 50–60 Hz primary input power. Center terminal is chassis ground. Uses Belden No. **17258-S cable.**

FUSE

Contains 3AG type, SLO-BLO fuse; 1/2A for 115V operation or 1/4A for 230V operation.

1.4 SPECIFICATIONS

INPUTS

FREQUENCY RANGE . . . . . 5Hz–5 kHz

ACCEL NO. 1

Amplitude . . . . . 1 to 1000g full scale
Sensitivity . . . . . .10 mV (peak)/g (peak)
Impedance . . . . . .1 MΩ

ACCEL NO. 2

Convenience input for second accelerometer, when SD115A is used in BYPASS mode.

PRESET
(used as calibration signal to preset levels, and to preset smooth crossovers using NULL meter)

Amplitude . . . . . Variable amplitude sine wave (from a Model SD105A-CLP or a Model SD105B)

DC ∝ LOG FREQUENCY (used for crossover switching)

Amplitude . . . . . 0 to 1 Vdc from SD104A-5 Sweep Oscillator

DC ∝ LIN FREQUENCY (used for internal control signal)

Amplitude . . . . . .0 to 10 Vdc from SD104A-5 Sweep Oscillator

OUTPUTS

ACCEL NO. 1 (connects to Accel No. 1 input of SD105B Servo)

Impedance . . . . . .<600Ω

Full Scale Ranges . . . . . .

Accel (g) (5–5,000 Hz)	Velocity (in./s) (5–1,000 Hz)	Displ (in./s) (5–1,000 Hz)
1,000	100	10
100	10	1
10	1	0.1
1	0.1	0.01

ACCEL NO. 2 (connects to Accel No. 2 input of **SD105B Servo**)

Amplitude	1000, 100, 10 and 1g full scale
Sensitivity	10 mV (peak)/g (peak)
Impedance	<600Ω

MISCELLANEOUS

INPUT/OUTPUTS . . . . . BNC connectors on rear of chassis

POWER . . . . 105–125/210–250 Vac, switch-selectable on rear of chassis, 50/60 Hz at ≈25W

DIMENSIONS

Height	3-1/2" (8,89 cm)
Width	19" (48,3 cm) (standard panel)
Depth	14" (35,6 cm) w/o connectors
Shipping Weight	11 lbs (4,98 kg)

SECTION II

OPERATION

2.1 GENERAL

The Model SD115A Automatic Level Programmer was specifically designed for use in a system employing a Model SD105B Amplitude Servo/Monitor and a Model SD104A-5 Sweep Oscillator. If the instrument is purchased as part of a system, refer to the applicable system instruction manual which includes installation and operation instructions for the SD115A. See Figures 1-2 and 1-3 in Section I of this manual for the description and location of all operating controls, indicators, and connectors. Review also the block diagram description in Section III.

The following operational check and operating instructions are provided mainly for the user who has purchased the SD115A for integration into an existing system. In this case, Figure 2-1 provides the basic interconnections required between the SD115A and associated SD105B and SD104A-5 units. Figure 2-2 provides construction details and parts list for Cable Assembly SDC 11551-1.

CAUTION

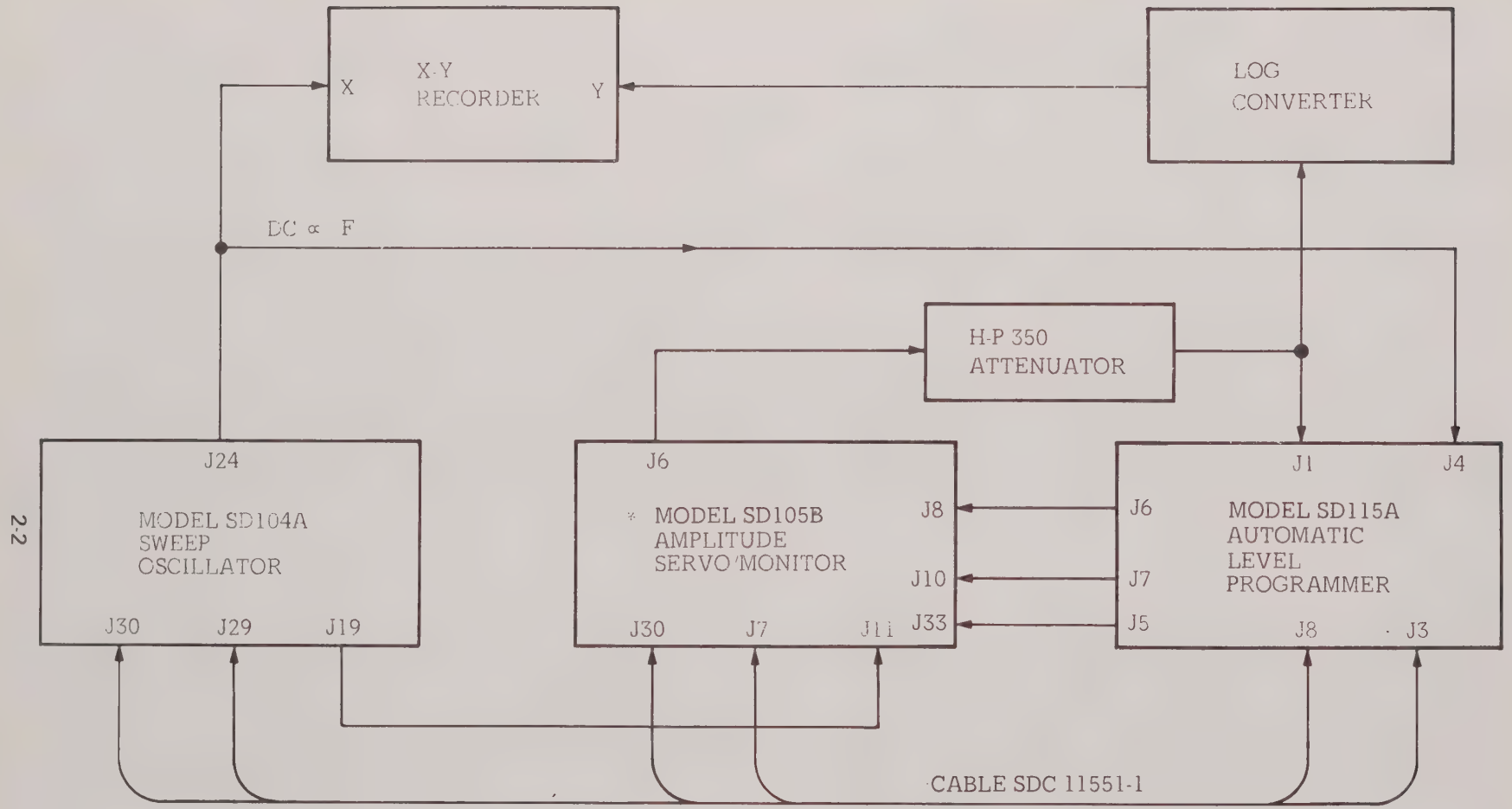
> The SD115A is powered when the line cord is plugged into the primary power receptacle. When installing the unit, facilities should be made to control its input power along with the SD105B Amplitude Servo/Monitor, by means of a master power switch.

2.2 OPERATIONAL CHECK

Perform the following procedure to ensure that the instrument is functioning properly.

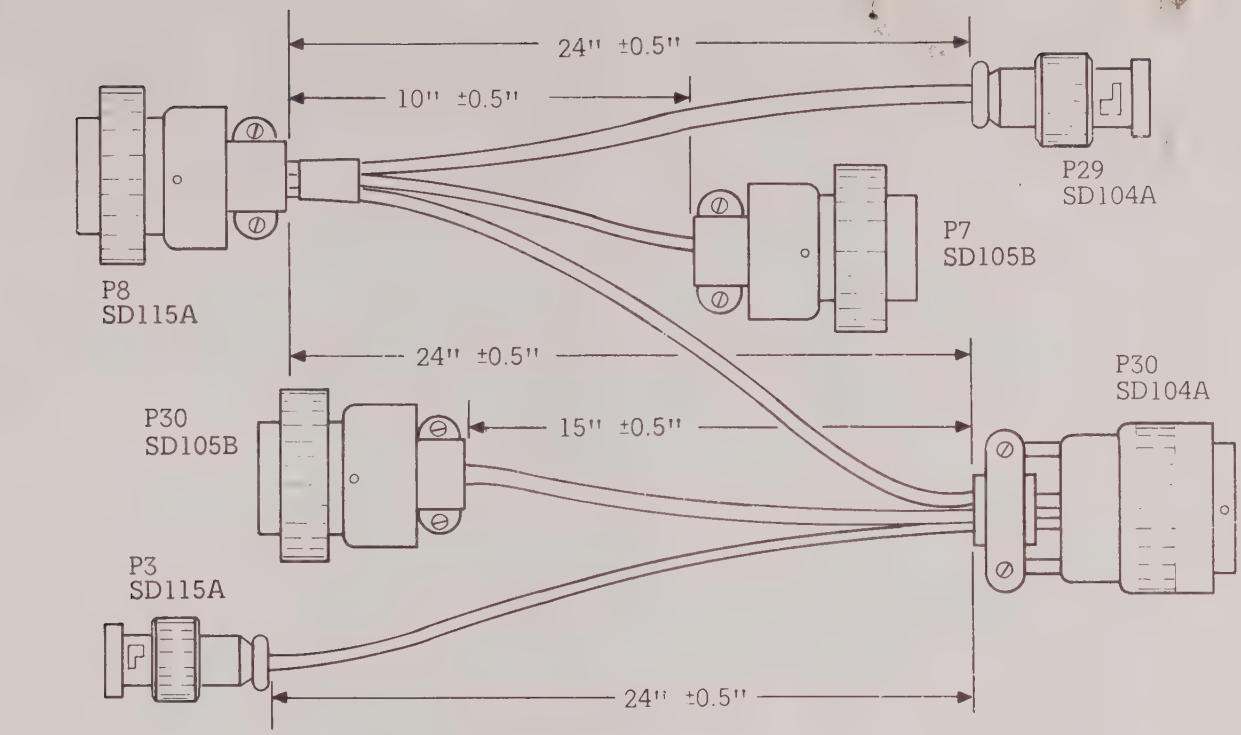
a. Check that the 115/230 switch on instrument rear chassis is set to proper input line voltage and that proper fuse is installed.

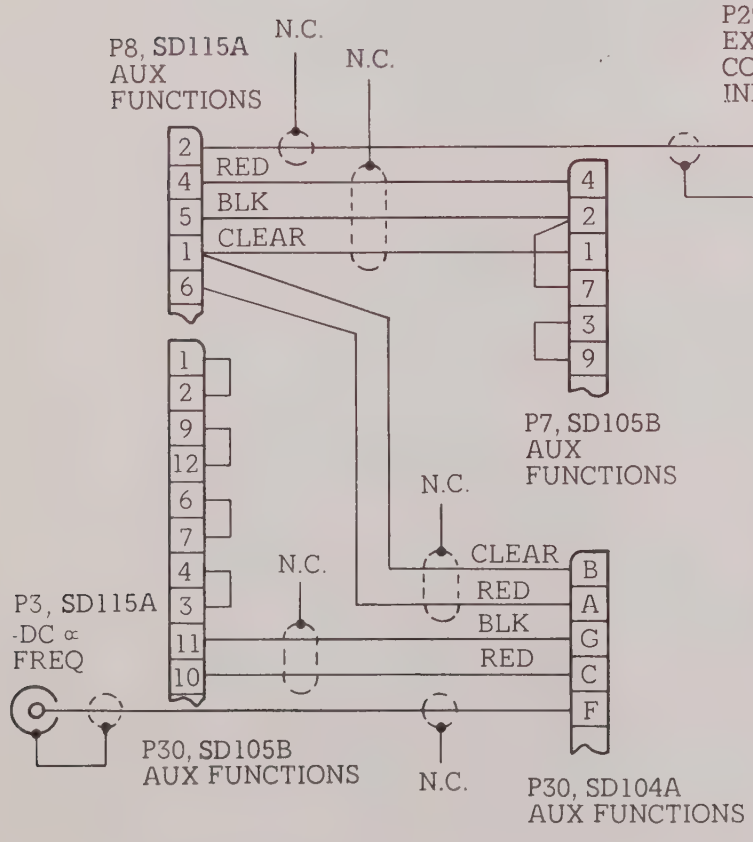
b. Interconnect the SD115A, SD104A-5, SD105B, etc., as shown in Figure 2-1.



*In units below S/N 201, ensure that a connection exists between pin 4 of AUX FUNCTION connector J7 and pin 4 of interlock relay K1.

Figure 2-1. Equipment Setup for Operational Checkout





CABLE ASSY SDC 11551-1

P8	SK-19-21C-½
P29	UG-88 B/U
P7	GK-9-21C-½
P3	UG-88 B/U
P30 (SD104A) . .	PTO6E-16-26P(SR)
P30 (SD105B) . .	GK-12-21C-½

Figure 2-2. SD115A, SD104A, and SD105B Interconnection Cable SDC 11551-1

NOTE

For interconnection of the SD115A with early models of the SD104 (not SD104A), make a jumper connection between pins A and B of J30 in the SD104. The jumper DOES NOT extend the interlock function of the SD105B to include the SD104.

c. Apply power to all instruments. The SD104A requires at least a 1-hour warmup.

d. **On SD115A, set the front-panel switches and controls as follows:**

A-V-D Range	Setting
1	DISPL (IN. P-P), 0.1
2	ACCEL (g), 10
3	ACCEL (g), 100
4	DISPL (IN. P-P), .01
5	VEL (IN/SEC), 10
6	ACCEL (g), 100
Crossover Potentiometer (2-3, 3-4, etc.)	Full clockwise
Mode Switch	**PRESET 1**

e. **On SD115A rear panel, ensure BYPASS/NORMAL switch is set to NORMAL.**

f. On **SD105B**, set the front-panel switches and controls as follows:

FUNCTION	ACCEL INPUT A
CROSSOVER	OFF
A-V-D level select	ACCEL (g) 100
COMPRESSOR	AUTO
SPEED	5
LIMIT	–Full clockwise
PRESET	A-V-D
OUTPUT	°(Full CCW in switch detent)
ACCEL (g) switch	100
S1 (rear chassis)	SEP

g. On SD104A-5, set the front-panel switches and controls as follows:

MULTIPLIER (A)	1
SWEEP RATE	3
MULTIPLIER (B)	1
Mode switch	MAN.
Frequency out	200 Hz
SWEEP RATE (rear panel)	INT

NOTE

Before proceeding with step h., ensure that the SD104A-5 has warmed up for at least 1-hour; SD115A and SD105B, for 15 minutes.

h. On SD105B, adjust A-V-D LEVEL for 50g on A-V-D meter.

i. On SD105B, set PRESET switch to OPER.

ON SD 115A SET MODE SWITCH TO PRESET 1

j. On SD115A, adjust LEVEL 1 potentiometer control for 0.1 inch p-p on SD105B ACCELERATION meter. (Meter reads 10.)

k. On SD115A, set Mode switch to PRESET 2.

l. On SD115A, adjust LEVEL 2 potentiometer control for 10g on SD105B ACCELERATION meter. (Meter reads 10.)

m. On SD115A, set Mode switch to PRESET 3.

n. On SD115A, adjust LEVEL 3 potentiometer control for 20g on SD105B ACCELERATION meter. (Meter reads 2.)

o. On SD115A, set Mode switch to PRESET 4.

p. On SD115A, adjust LEVEL 4 potentiometer control for 0.00145 inch p-p on SD105B ACCELERATION. (Meter reads 1.45.)

q. On SD115A, set Mode switch to PRESET 5.

r. On SD115A, adjust LEVEL 5 potentiometer control for 1.85 in./s on SD105B ACCELERATION meter. (Meter reads 1.85.)

s. On SD115A, set Mode switch to PRESET 6.

t. On SD115A, adjust LEVEL 6 potentiometer control for 22g. (Meter reads 2.2.)

NOTE

When programming a step-change crossover, it is permissible for the SD115A NULL meter and the SD105B A-V-D and ACCELERATION meters to go off scale. Only the SD104A frequency meter is used to program the desired crossover frequency.

u. On SD115A, set Mode switch to CROSSOVER ADJ 1-2.

On SD104A, set Mode switch to EXT.

v. On SD115A, adjust crossover potentiometer 1-2 for approximately 44 Hz for SD104A meter.

w. On SD115A, adjust crossover potentiometer 1-2 for a null on NULL meter.

x. On SD115A, set Mode switch to CROSSOVER ADJ 2-3. This is a step-change crossover; therefore, adjust crossover potentiometer 2-3 for 100 Hz on SD104A meter.

y. On SD115A, set Mode switch to CROSSOVER ADJ 3-4. This is a step-change crossover; therefore, adjust crossover potentiometer 3-4 for 200 Hz on SD104A meter.

z. On SD115A, set Mode switch to CROSSOVER ADJ 4-5. (This is a smooth crossover.)

aa. On SD115A, adjust crossover potentiometer 4-5 for approximately 406 Hz on SD104A meter.

bb. On SD115A, adjust crossover potentiometer 4-5 for a null on NULL meter.

cc. On SD115A, set Mode switch to CROSSOVER ADJ 5-6. (This is a smooth crossover.)

dd. On SD115A, adjust crossover potentiometer 5-6 for approximately 734 Hz on SD104A meter.

ee. On SD115A, adjust crossover potentiometer 5-6 for a null on NULL meter.

ff. On SD115A, set Mode switch to AUTO.

gg. On SD104A, set Mode switch to LOG SWEEP SINGLE.

hh. On SD104A, adjust SWEEP LIMITS: LOWER, 10 Hz; UPPER, 2000 Hz.

ii. Calibrate recorder to accept program: X-axis, 10—2000 Hz; Y-axis, 1—25g.

jj. On SD104A, press RESET DOWN push button.

kk. Refer to SD105B Instruction Manual and bring SD105B "on-the-air".

ll. On SD104A, press SWEEP UP push button and observe recorded program.

The program should be as shown in the typical test level profile of paragraph 1.1 in Section I. If any of the smooth crossover points are irregular, repeat the preceding steps that are applicable to that portion of the program.

CAUTION

Do not move the LEVEL potentiometers. If one is moved, that Level will have to be reprogrammed, including the adjacent crossover adjustments.

2.3 OPERATION

NOTE

Before operating the SD115A with a shaker system, it is recommended that the operator become familiar with programming the SD115A by performing the OPERATIONAL CHECK of paragraph 2.2. For this check, the SD115A, SD104A, and SD105B are connected as shown in Figure 2-1, with an H-P 350 substituted for the shaker system.

To set up the SD115A for normal operation, proceed as follows:

a. Outline the operational program by listing the desired six A-V-D levels, crossover frequencies, etc. (Roughly compute the smooth crossover frequencies.) The usable A, V, and D parameters are included within the heavy outlines on the graphs of Figures 2-3, 2-4, and 2-5.

b. On SD105B, set OUTPUT control to PRESET (full CCW in switch detent).

c. Adjust shaker system MASTER GAIN to OFF.

d. Apply power to the system and allow at least 1-hour warmup for the SD104A Sweep Oscillator.

e. On SD115A, set the six front panel A-V-D range switches to the proper settings in accordance with the program.

*

NOTE

The A-V-D Level switch markings indicate full-scale range. For example, to program displacement from 0.11 in. p-p to 1 in. p-p, set switch to DISPL (IN. P-P) position 1.

f. On SD115A, adjust crossover potentiometers 2-3, 3-4, etc., fully clockwise.

g. On SD115A, set Mode switch to 1.

h. On SD115A rear chassis, ensure BYPASS/NORMAL switch is set to NORMAL.

*Revised (2-17-72)

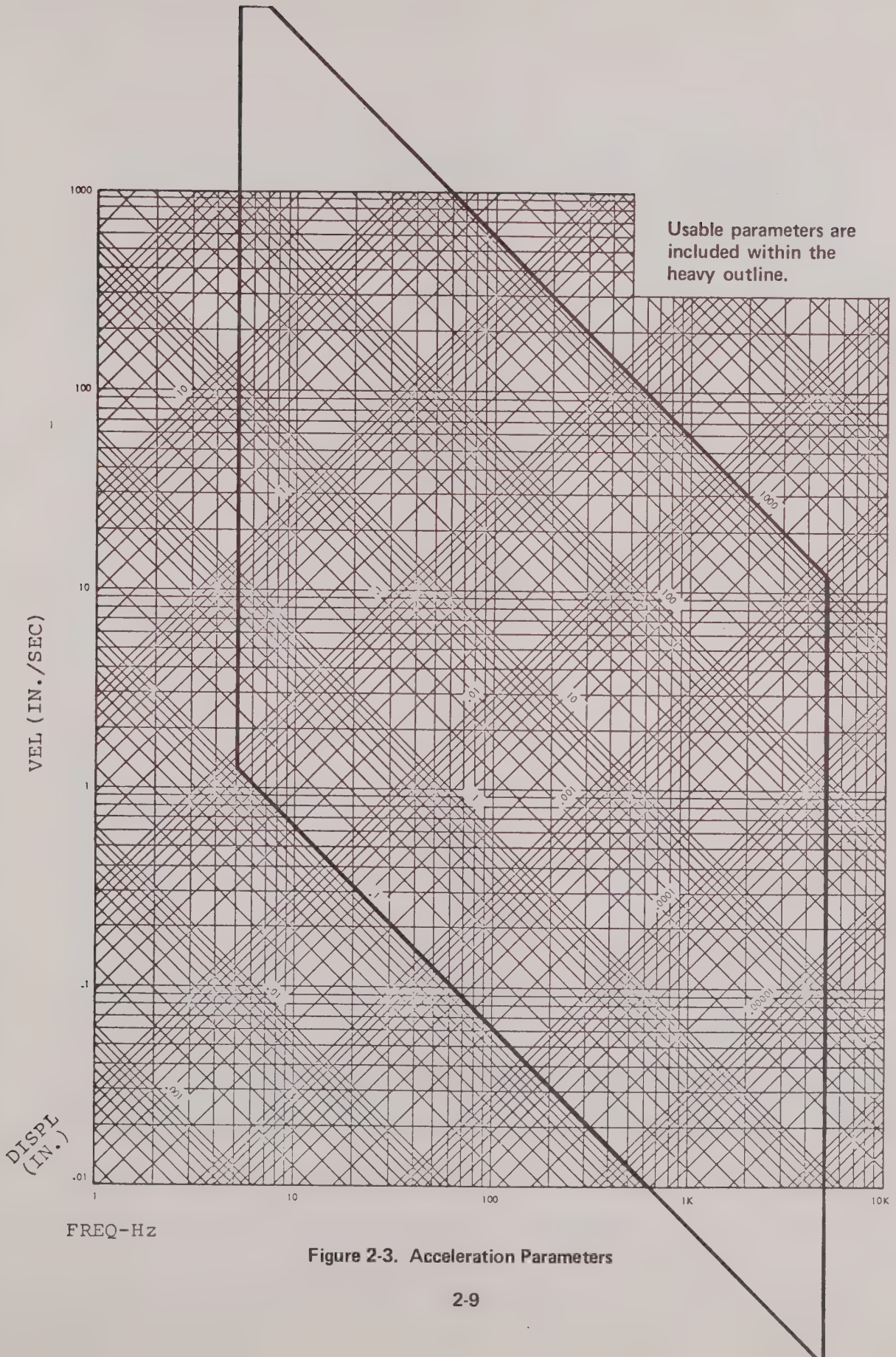


Figure 2-3. Acceleration Parameters

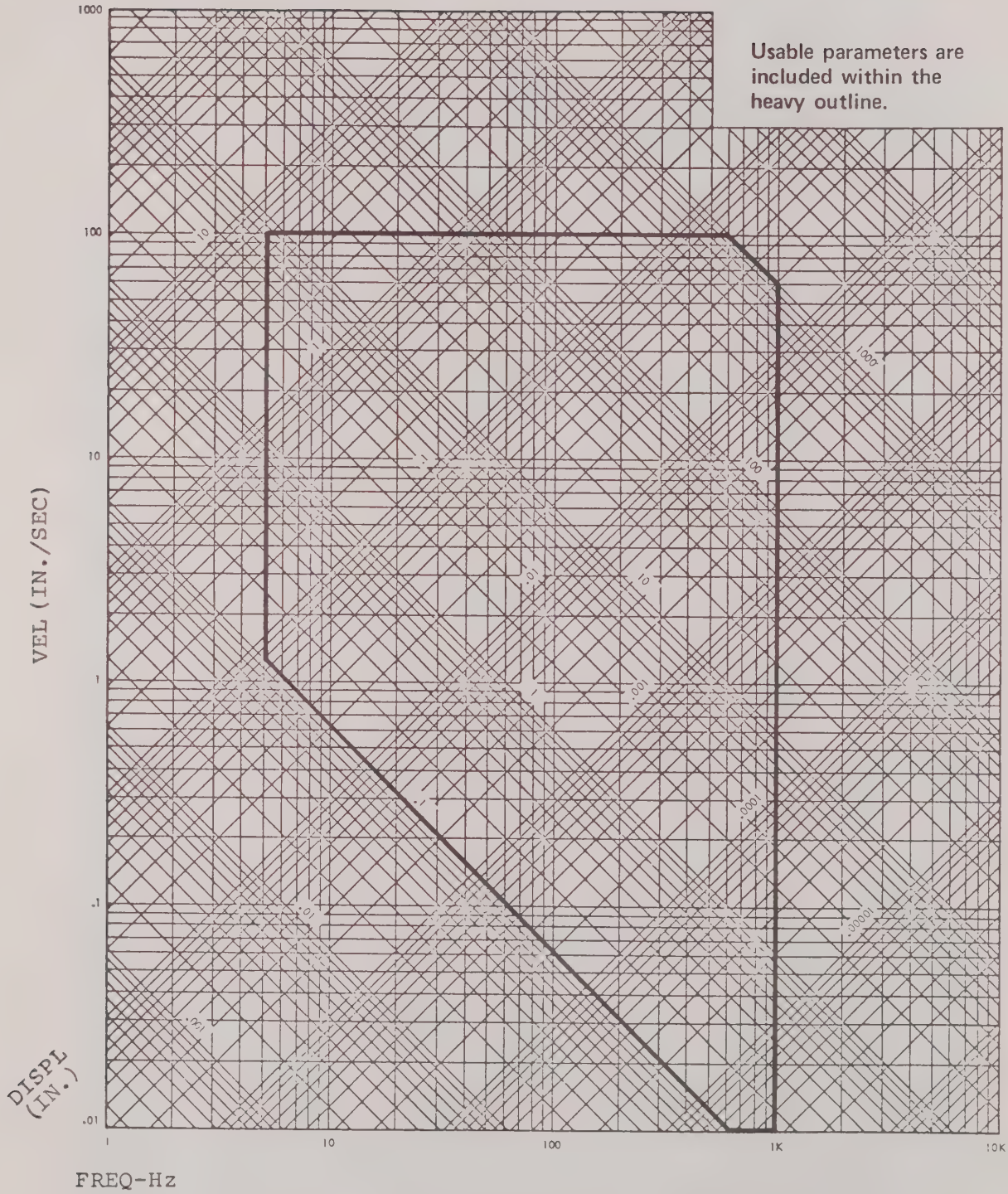


Figure 2-4. Velocity Parameters

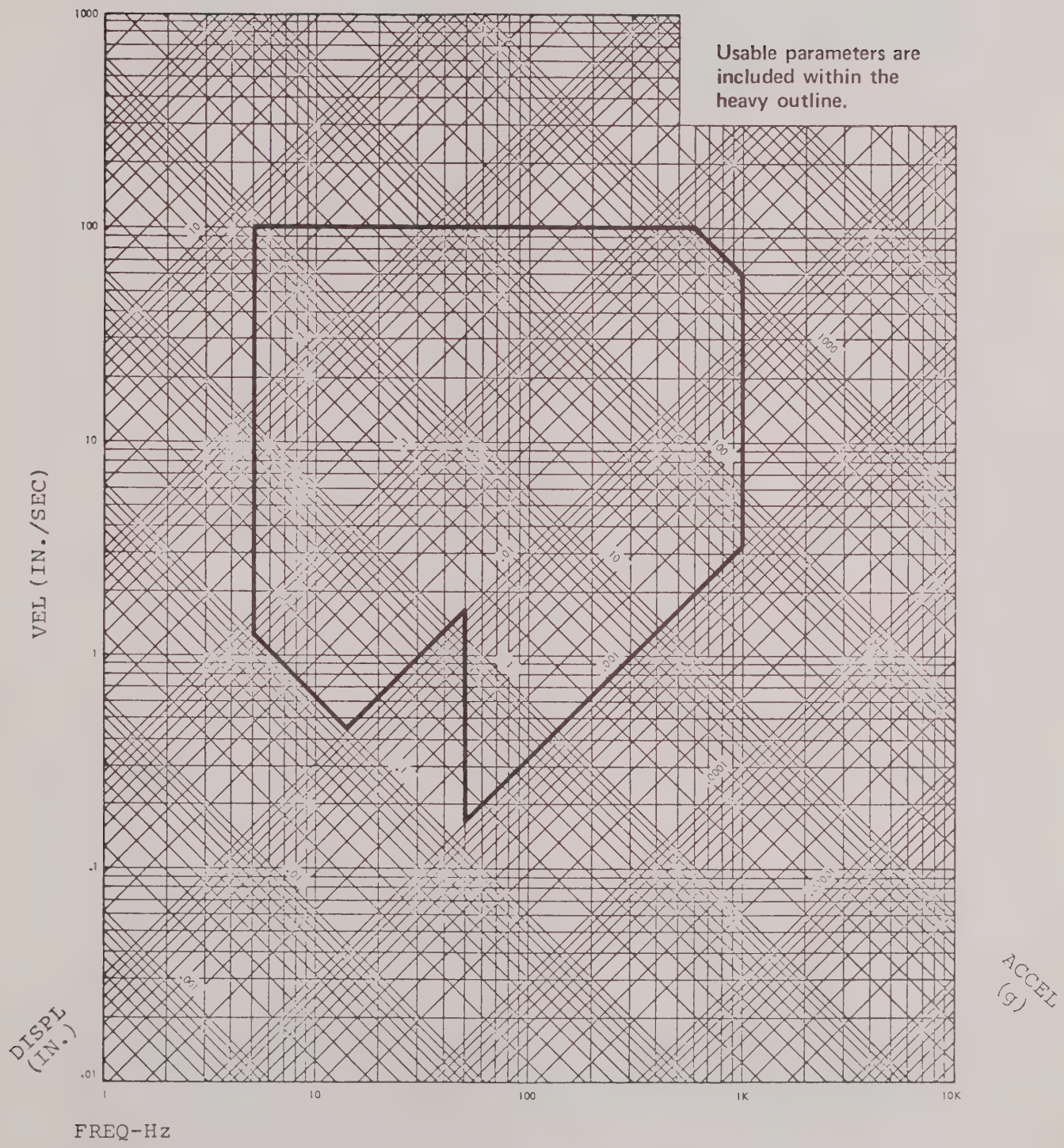


Figure 2-5. Displacement Parameters

i. On **SD105B**, set the front-panel switches and controls as follows:

FUNCTION	ACCEL INPUT A
CROSSOVER	OFF
A-V-D level select	ACCEL (g) 100
COMPRESSOR	AUTO
SPEED	5
LIMIT	Full clockwise
PRESET	A-V-D
OUTPUT	°(Full CCW in switch detent)
ACCEL (g) switch	100

j. On SD104A-5, set the front-panel switches and controls as follows:

MULTIPLIER (A)	1
SWEEP RATE	3
MULTIPLIER (B)	1
Mode switch	EXT
Function	∿

NOTE

Before proceeding with **step k.**, ensure that the SD104A-5 has warmed up for at least 1-hour; **SD115A and SD105B, for 15 minutes.**

k. On SD105B, adjust A-V-D LEVEL for 50g on A-V-D meter.

l. On SD105B, set PRESET switch to OPER.

NOTE

If less than six levels are programmed, always start with Level 1. The unused higher number Levels will be skipped as a function of the crossover adjustments made in **step n.**

m. Preset the desired A, V, or D parameters for each level (1 through 6) as follows: Sequentially set the Mode switch to PRESET positions 1 through 6. At each setting, adjust the corresponding LEVEL control for the desired parameter of A, V, or D as read on the SD105B ACCELERATION meter.

n. Preset the crossover potentiometers in sequence 1-2, 2-3, 3-4, etc., as follows: Sequentially set the Mode switch to CROSSOVER ADJ positions 1-2, 2-3, etc. At each setting, adjust the corresponding crossover potentiometer for the proper crossover frequency as read on the SD104A (step-change crossover), or for a null on SD115A NULL meter. (Review NOTE preceding step u., and procedural steps u. through ee. of paragraph 2.2.) If less than six levels (five crossovers) are programmed, adjust the unused higher number crossover potentiometer (5-6, 4-5, etc.), fully clockwise.

CAUTION

Do not move LEVEL potentiometers. If one is moved, that Level will have to be reprogrammed, including the adjacent crossover adjustments.

The multi-level program is now preset in the SD115A. Normal automatic operation is initiated as follows:

o. On SD115A, set Mode switch to AUTO.

p. On SD104A, set Mode switch to LOG SWEEP SINGLE.

q. On SD104A, adjust SWEEP LIMITS as required by the program.

r. If a recorder is used, calibrate it to accept the program.

s. On SD104A, press RESET DOWN push button.

t. Refer to SD105B Instruction Manual and bring system "on-the-air".

u. On SD104A, press SWEEP UP push button, and program will run automatically.

Any one of the six preset levels can be separately selected by setting the SD115A Mode switch to the level desired (1, 2, 3 --- or 6).

SECTION III

CONCEPT AND THEORY OF OPERATION

3.1 CONCEPT OF OPERATION

The Model SD115A ALP operates as an integral part of a servo loop in a sine servo shaker to provide programmed control of up to six preset levels of acceleration, velocity, or displacement. A-C signals proportional to velocity and displacement are produced by single- and double- integration respectively of a single acceleration signal input. Solid-state circuitry controlled by a d-c voltage $\propto$ frequency from the system sweep oscillator provides automatic and smooth crossover switching between levels.

3.2 BLOCK DIAGRAM DESCRIPTION

The following paragraphs describe in sequence the operation of the SD115A in each of its operational modes. It is assumed that the SD115A is operating in a system and is interconnected to a Model SD105B Amplitude Servo/Monitor and a Model SD104A-5 Sweep Oscillator as prescribed in Section II of this manual.

First, the SD115A is programmed by presetting each of the six levels and frequency crossovers. Then, with the mode switch set in the AUTO position, the six programmed levels are automatically selected in sequence (1–6) as a function of the system excitation frequency.

3.2.1 Preset Level Adjustment

NOTE

> Although the six A-V-D range switches are not used during preset operation, they should be set to the proper A, V, or D values in accordance with the program. This will prevent the possible disturbance of the LEVEL potentiometers after they have been set.

The ACCEL No. 1 and No. 2 outputs of the SD115A are calibrated to the SD105B at the desired level of operation for each of the six operational levels, using the individual level potentiometer controls on the front panel. The desired program level is set up in ACCEL No. 2 channel as read on the SD105B ACCELERATION meter. All six levels are preset in the same manner; therefore, only level 1 is described in the following.

The SD115A mode switch S7 is first set to 1. (See Figure 3-1.) The SD105B OUTPUT control is set to the extreme CCW position (PRESET detent). In this condition ≈24 Vdc from the SD105B is routed through AUX FUNCTIONS connector J8 to relay drivers (A5Q13 and -14) which energize both relays K1 and K2. With relays K1 and K2 energized, the input A-V-D integrators, the level select switches, and associated buffers are not used. A calibration signal from the PRESET INPUT is applied to each LEVEL potentiometer (R1—R6).

Each LEVEL potentiometer provides two outputs: One output is the same as its input voltage level which is determined by the setting of the LEVEL potentiometer. These pairs of signals are applied to the transfer switching circuitry at the inputs of ACCEL No. 2 and ACCEL No. 1 FET buffers.

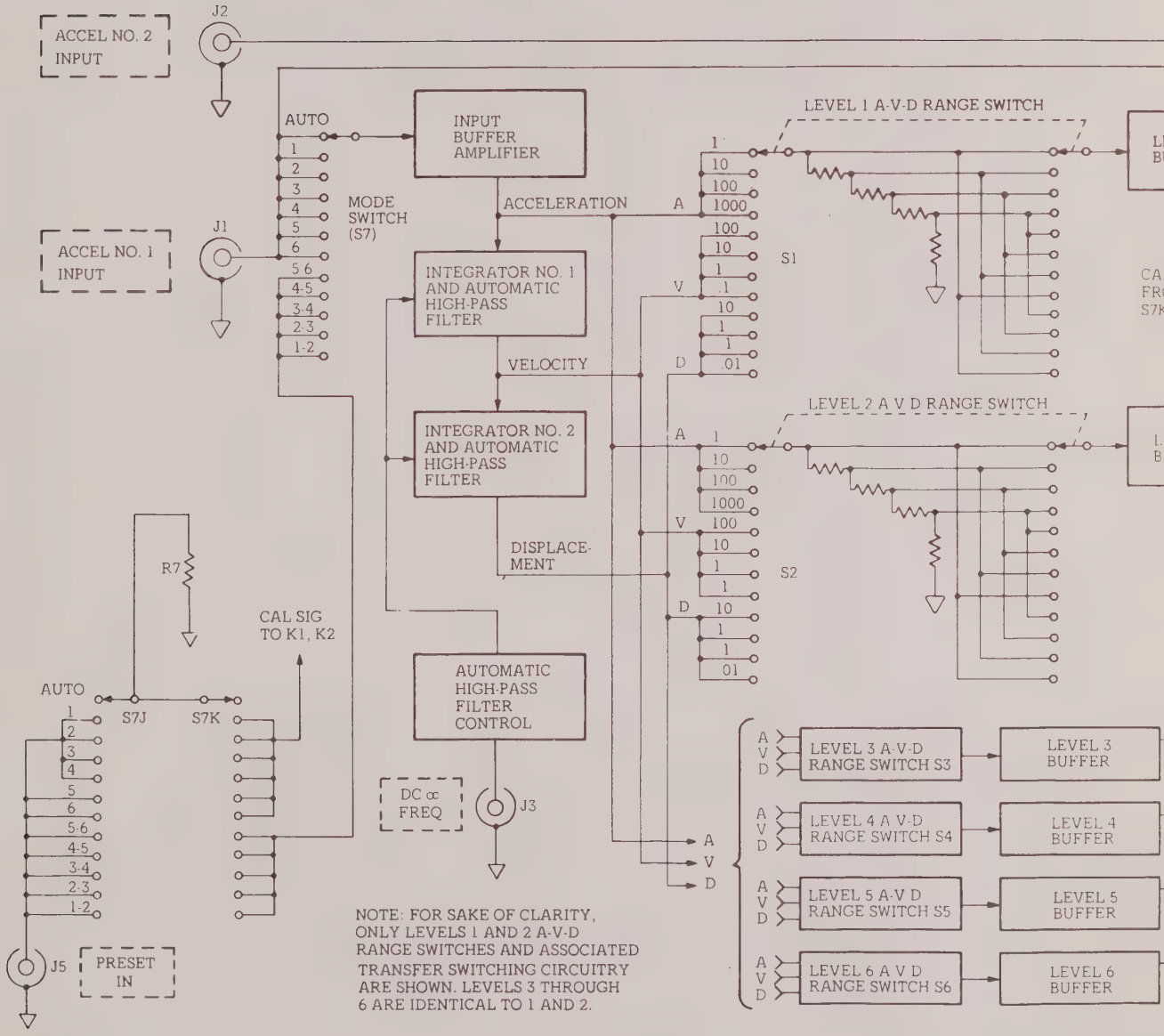
The transfer switches are controlled by the crossover switching circuitry. With the SD115A mode switch set to 1, only junction points "A" and "G" are high impedance, allowing the Level 1 signals to pass through; all other junction points are grounded by their associated FET switches. A diode matrix at the inputs to all crossover switch FET's allows only one of the six level pairs to be selected at any time; also, by means of the mode switch (S7E), a fixed enabling voltage is applied only to the selected crossover switching amplifier. The output of ACCEL No. 2 FET buffer is amplified by a factor of 10, buffered, and routed through ACCEL No. 2 OUTPUT (J7) to ACCEL No. 2 INPUT of the SD105B. The output of ACCEL No. 1 FET buffer is amplified by a factor of 50, buffered, and routed through ACCEL No. 1 OUTPUT (J6) to ACCEL No. 1 INPUT of the SD105B.

In sequence, the SD115A mode switch is set to positions 2 through 6, and each level is preset as described above for Level 1. After all levels are calibrated to the SD105B, the desired level crossover points are programmed as described in the following paragraphs.

3.2.2 CROSSOVER Adjustments

The SD104A-5 output frequency is controlled by a d-c voltage from the SD115A. See Figure 3-2, and note that the SD104A-5 is in a closed loop with the SD115A crossover adjust circuitry. The DC ∝ LOG FREQ from the SD104A-5 is summed with a voltage adjusted by crossover adjust potentiometer 1-2 (R8). The difference voltage at "E" is integrated and used to control the SD104A VCO (voltage-controlled oscillator). The VCO is caused to change frequency until its DC ∝ LOG FREQ output equals the voltage at the arm of R8. Note, that the potential at summing junction "S" is also at zero, thereby holding off the level 2 switch driver.

If the program requires a stepped change between two levels at a specific frequency, the crossover adjust potentiometer is varied until the SD104A-5 output equals that frequency. If a smooth crossover is desired, the crossover adjust potentiometer is varied until the SD115A NULL meter indicates a null. (The null indication circuitry is described later.)



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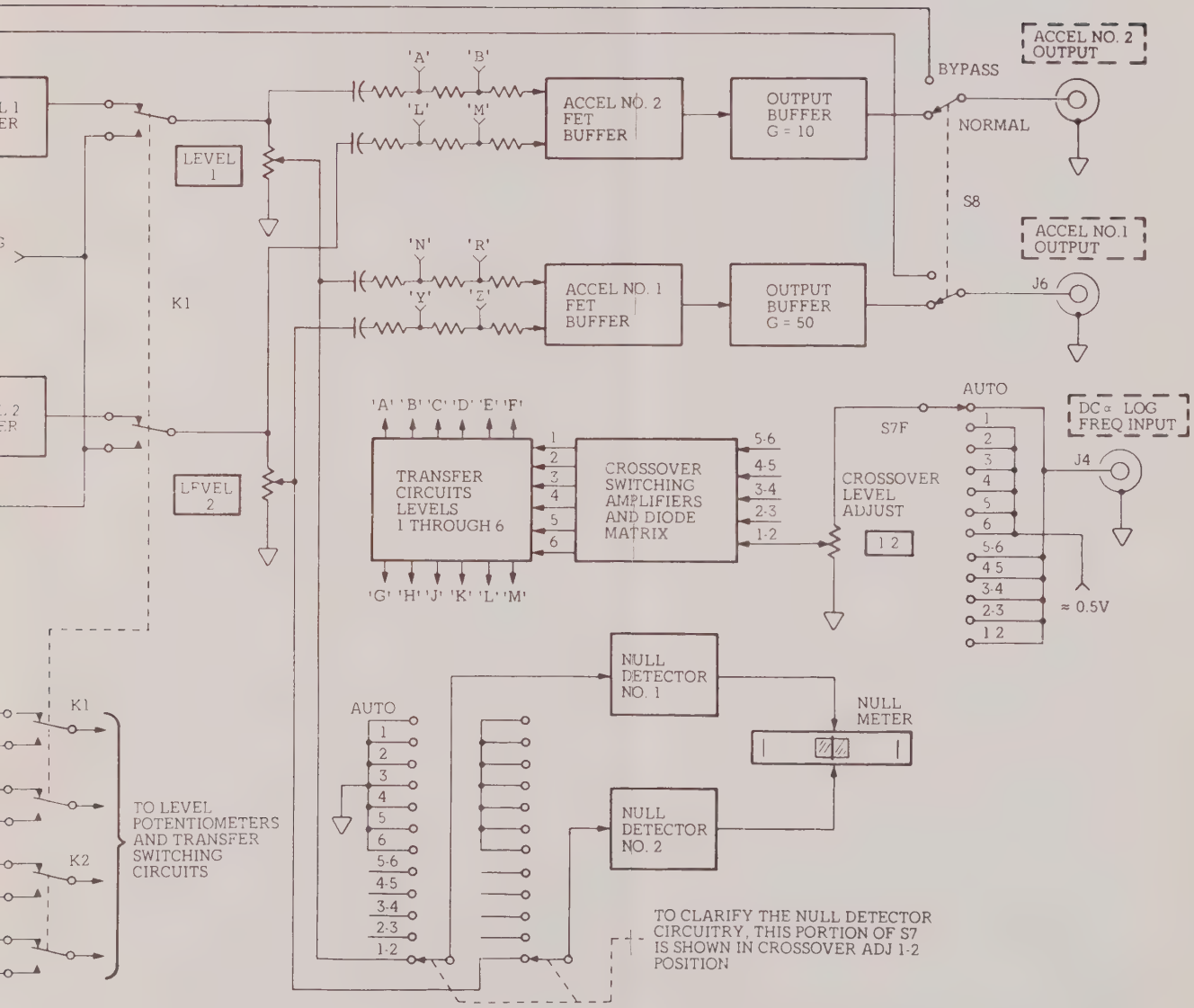


Figure 3-1. Functional Block Diagram Model SD115A Automatic Level Programmer

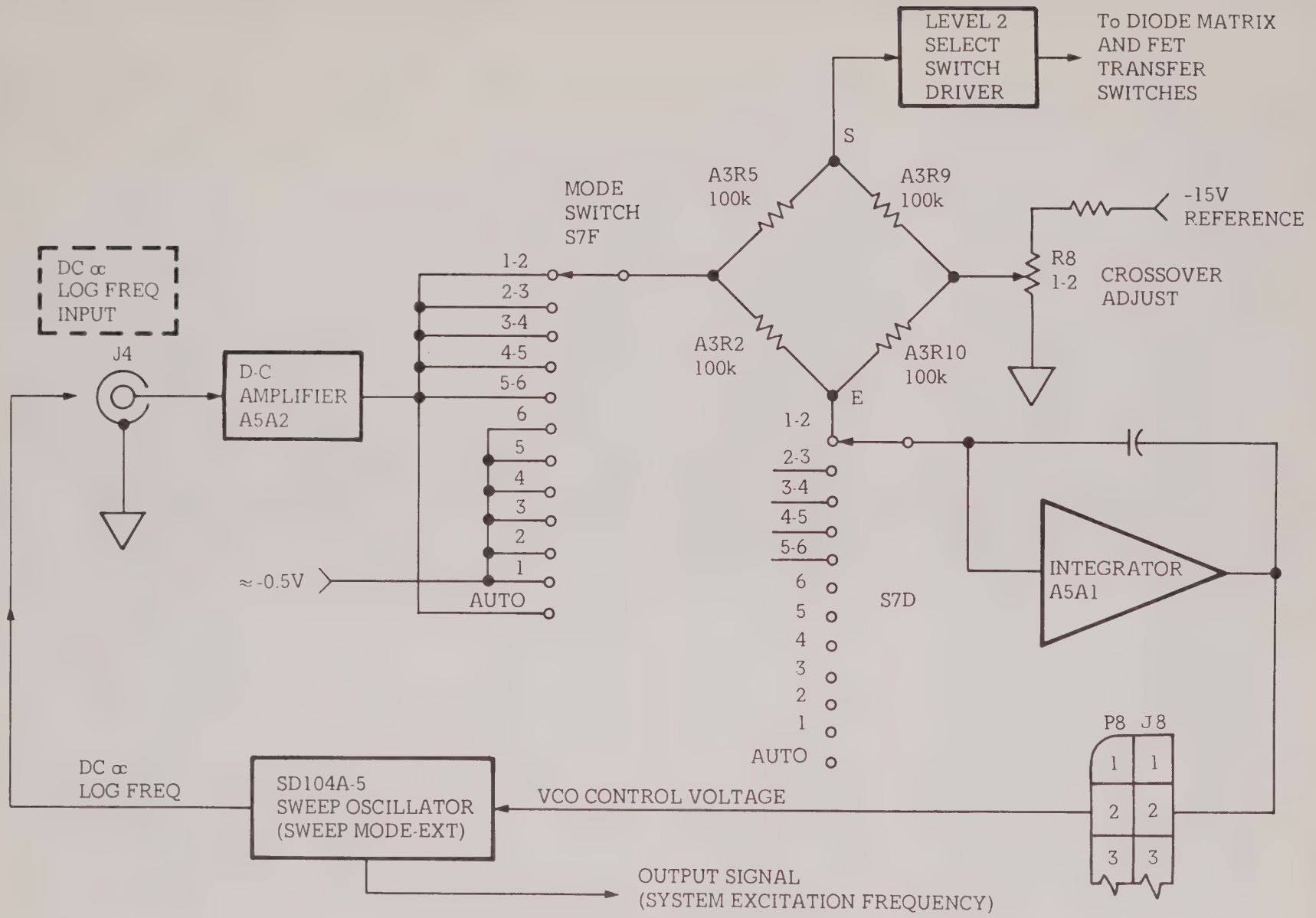


Figure 3-2. Functional Block Diagram of CROSSOVER ADJUST Circuitry

During normal automatic operation the loop is open. The SD104A sweeps up, and when the DC ∝ LOG FREQ exceeds the preset voltage, level-2 select switch driver is actuated causing the transfer switching circuitry to select Level 2. Each of the five crossover operations occurs in a similar manner as the frequency sweeps upward from below the lowest crossover frequency to above the highest.

The NULL meter and associated detectors facilitate programming a smooth crossover between any two sequential levels. Also, in the CROSSOVER ADJUST mode, relays K1 and K2 are de-energized, and a PRESET sine wave signal applied at J5 from the SD105B is used as the ACCEL 1 INPUT signal. The A-V-D assembly is activated, and all six preset levels of A, V, or D are available for selection.

It is recommended that the crossover frequency be roughly calculated; then the crossover adjust potentiometer is adjusted for that frequency on the SD104A. In CROSSOVER ADJUST mode, the signal level from the A-V-D integrators and subsequent buffers automatically simulate the control level. The detectors are identical with one exception; i.e., a gain calibration control in null detector No. 2 facilitates gain normalization.

See Figure 3-1, and note that the preset control signals from the two levels (Levels 1 and 2) being programmed are applied to the null detectors. Now refer to the typical test level profile and associated chart shown in Section I, paragraph 1.1. The approximate frequency for a smooth crossover between Levels 1 and 2 is 44 Hz. Crossover adjust potentiometer 1-2 is adjusted for ≈44 Hz on the SD104A and then crossover adjust potentiometer 1-2 is carefully adjusted for a null on the NULL meter.

A null indicates that the output amplitudes of Level 1 and Level 2 are equal at the adjusted crossover frequency.

3.2.3 AUTO Mode

This is the normal operating mode of the SD115A. After all Levels and crossover points have been programmed, the Mode switch is set to AUTO. The SD105B is brought "on-the-air" (refer to SD105B Instruction Manual). The SD104A upper and lower sweep limits are set, and the program is then run by an up-sweep from the SD104A.

As shown in Figure 3-1, the ACCEL NO. 1 INPUT signal is amplified, integrated once to develop a proportional velocity signal, and integrated a second time to develop a proportional displacement signal. The gain of an integrator inherently decreases as the operating frequency increases. Therefore, to prevent low-frequency noise components from overriding the higher frequency signals during an up-sweep, the automatic high-pass filter circuit continuously reduces the amplifier gain to all frequencies below the operating frequency (system excitation frequency). The variable component in the automatic high-pass filter circuit is the resistance provided by a photocell assembly. The $-DC \propto FREQ$ from the SD104A is amplified and used to control the intensity of the photocell lamp, which, in turn, varies the resistance afforded by the photocells.

As shown in Figure 3-1, the A, V, and D signals are applied to each A-V-D Range Switch. Each switch utilizes a single attenuation network to provide four calibrated amplitudes of the selected A, V, or D signal. The output of each A-V-D Range Switch is buffered and routed through the normally closed contacts of relay K1 (or K2) to the LEVEL controls. The subsequent transfer switching and crossover switching circuitry operates as described for CROSSOVER Adjustments (paragraph 3.2.2).

SECTION IV

CALIBRATION AND MAINTENANCE

4.1 GENERAL

Before calibration is attempted the technician is advised to study Sections II and III of this manual and familiarize himself with the front panel and rear chassis diagrams in Section I.

Top and bottom chassis views, Figures 4-1 and 4-2, are provided with reference designations of pertinent components. Schematic and component layout drawings are at the end of the manual.

All parts and test points mounted on circuit cards are designated by card location and reference number. For example, resistor R9 on circuit card A1 is referred to as A1R9.

If need for calibration is in doubt, perform the operational checks in paragraph 2.2, Section II, of this manual.

4.2 CALIBRATION PROCEDURE

To ensure proper calibration it is important that the following steps be performed in their entirety and in the given sequence.

Table 4-1 lists the test equipment required. Test equipment having equal or better operational characteristics may be substituted.

Table 4-1. Test Equipment Required

Name	Model No.	Manufacturer
Attenuator	350D	Hewlett-Packard
Digital Voltmeter	3440A	Hewlett-Packard
Frequency Counter	5223L	Hewlett-Packard
Oscilloscope	561A1	Tektronix
Time Base Plug-In	Type 67	Tektronix
Preamplifier Plug-In	Type B	Tektronix
X-Y Recorder	135A	Moseley
RMS Voltmeter	3400	Hewlett-Packard

In addition to the above mentioned test equipment calibration of the SD115A Automatic Level Programmer requires the use of Spectral Dynamics models SD104A Sweep Oscillator and SD105B Amplitude Servo/Monitor.

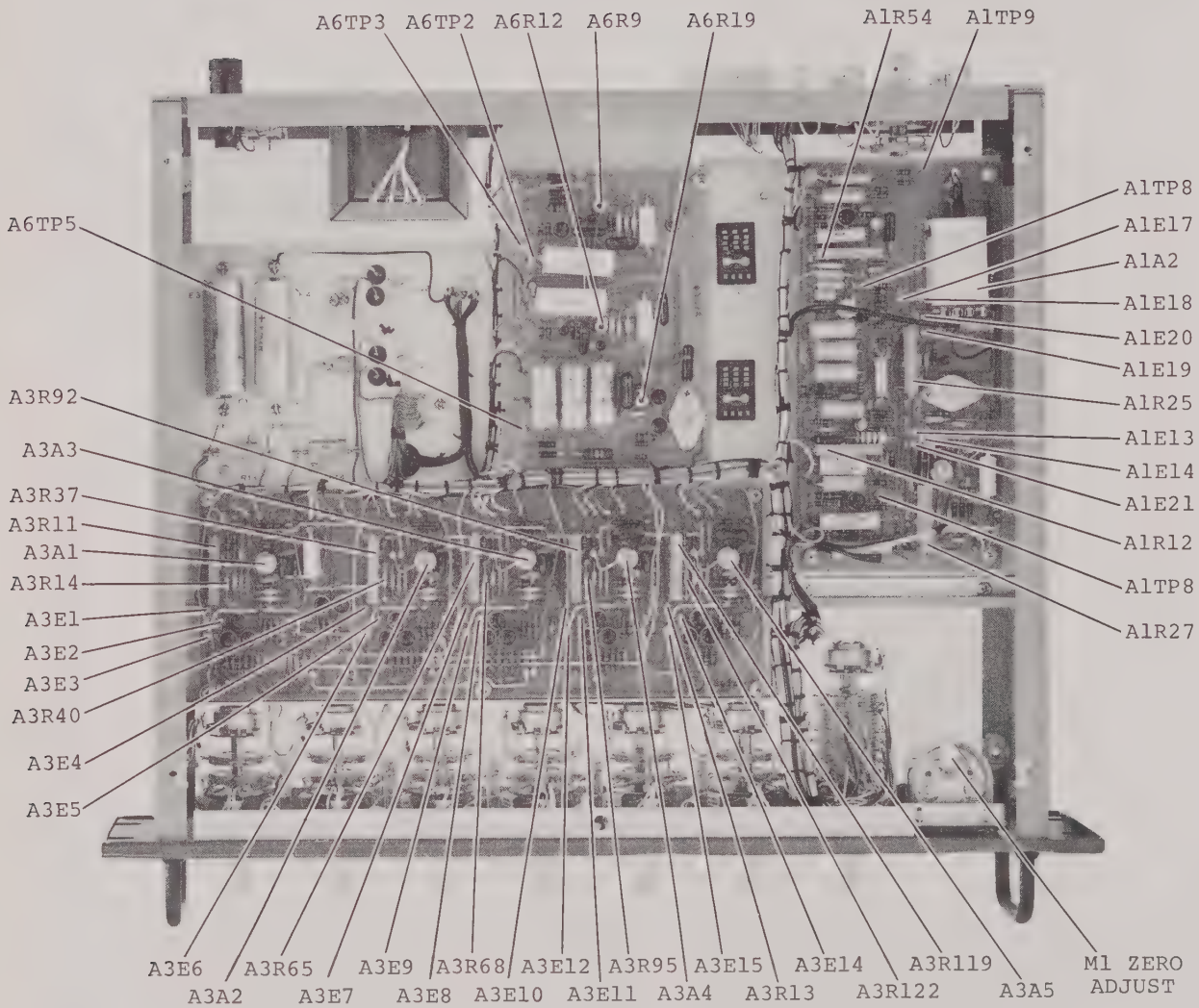
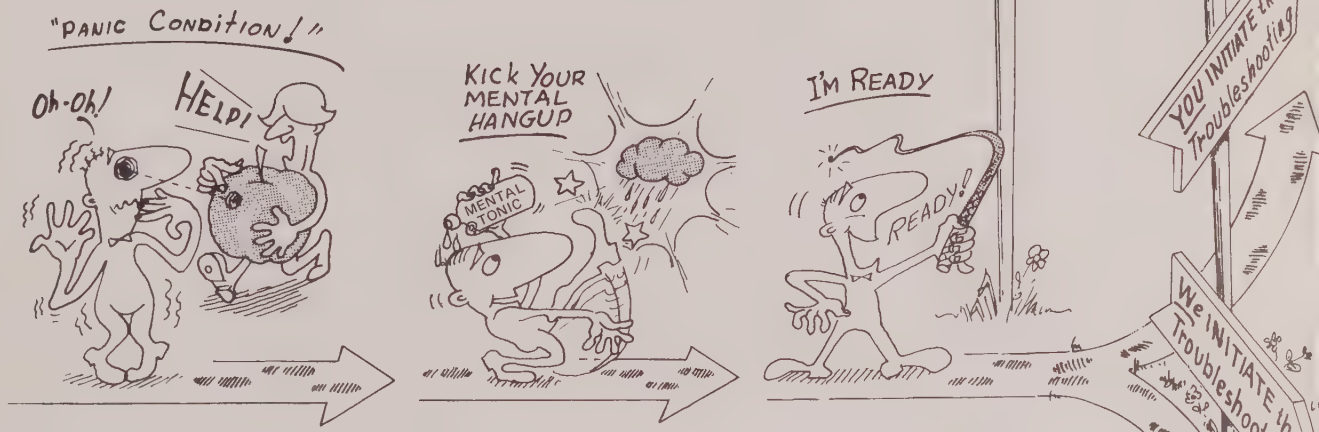


Figure 4-1. Chassis Top View

TROUBLESHOOTING ON EASY ST.



PANIC THOUGHTS

- I've never seen this one before!
- Does anybody know how it happened?
- They probably need it fixed yesterday!
- Who can I ask for help?

POSITIVE APPROACH

- Problem is probably simple.
- I can fix this problem easily.
- I am going to think logically.
- I am going to carefully evaluate the front panel indications.
- I'll talk to the person who had the problem.

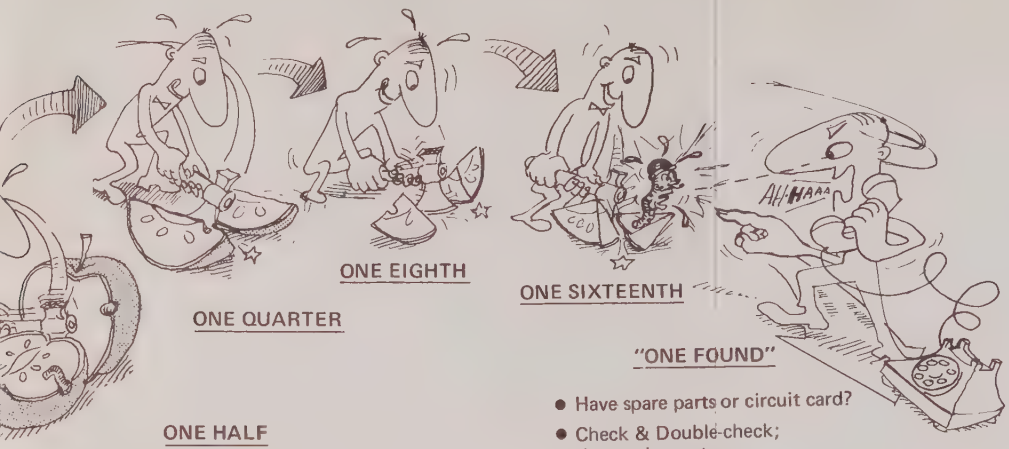
READY

- I can whip the problem NOW.

PREPARATION FO

- Have talked to pe experienced the p
- Have read the ma
- Have complete M Numbers from re

SUCCESSIVE HALF-SPLIT TROUBLESHOOTING METHOD



ONE QUARTER

ONE EIGHTH

ONE SIXTEENTH

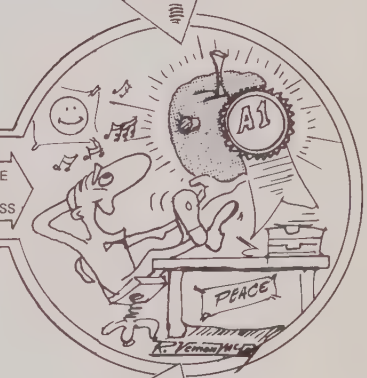
"ONE FOUND"

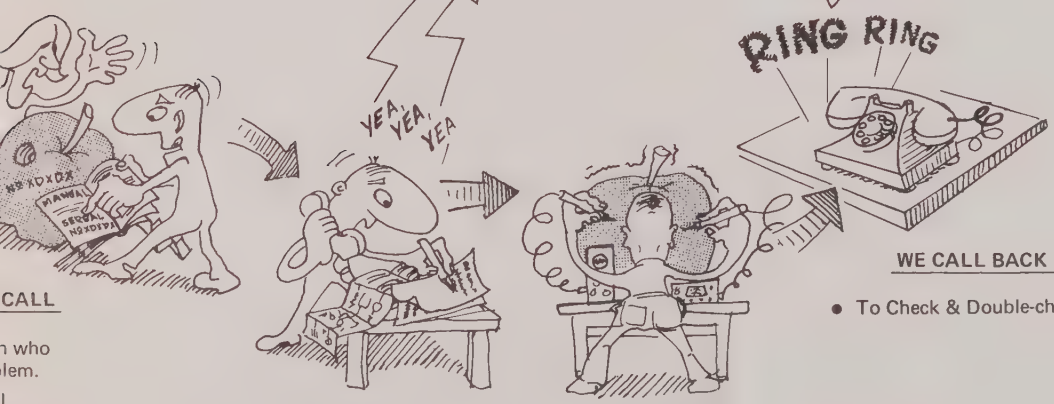
ONE HALF

- Evaluate front panel symptoms before removing cover.
- Look for obvious—simple problem.
- Do not adjust to "FIX" problems!

- Have spare parts or circuit card?
- Check & Double-check; then order parts.
- Prepare for call:
  Have correct part number from part or schematic.
  Have complete Model and Serial Numbers from rear of chassis.

The SDC Customer Service Team is At Your Service Aiming To Please





CALL

n who
blem.
l.
l and Serial
f chassis.

YOU CALL FOR INSTRUCTIONS

- We spell out tests.

YOU PERFORM CHECKOUT

- As instructed

WE CALL BACK

- To Check & Double-check

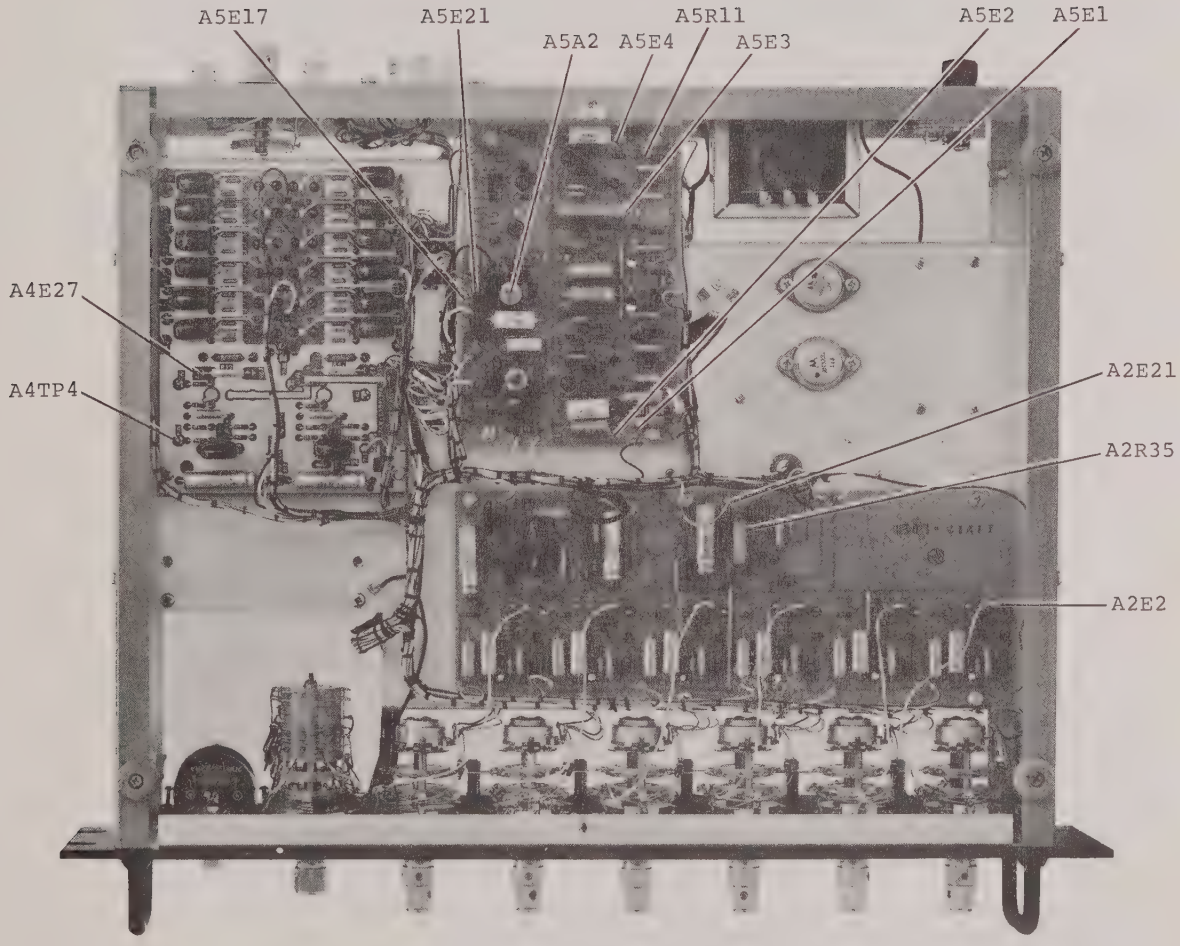


Figure 4-2. Chassis Bottom View

4.2.1 Preliminary – Power Off

a. Remove top and bottom covers.

b. Mechanically adjust NULL meter for centerline position in the green area. A small paper sticker covers the hole through which this adjustment is made.

c. Check for proper setting of the 115/230 switch (S9) on the rear of the chassis, and for proper fuse value as indicated in FUSE DATA chart on rear of chassis.

d. Make external connections to the SD115A as shown in Figure 2-1, Section II. Refer to Figure 2-2 for construction details of Interconnection Cable SDC11551-1.

e. Connect power cord to primary power source. Turn the BYPASS/NORMAL switch to NORMAL; one of the A-V-D indicator lamps should glow, indicating that power is on. Allow a 15-minute warmup.

4.2.2 Power Supply

a. Connect a DVM to A6TP3. Adjust A6R12 for -15.00V (-14.99 to -15.01V).

b. Connect oscilloscope to A6TP3. Ripple should be less than 1 mV p-p.

c. Connect a DVM to A6TP2. Adjust A6R9 for +15.00V (14.99 to 15.01).

d. Connect oscilloscope to A6TP2. Ripple should be less than 1 mV p-p.

e. Connect a DVM to A6TP5. Adjust A6R19 for +50.00V (49.95 to 50.05V).

f. Connect oscilloscope to A6TP5. Ripple should be less than 5 mV p-p.

4.2.3 Automatic High-Pass Filter
(Required only upon replacement of PHOTO CELL ASSEMBLY A1A2.)

Set the BYPASS/NORMAL switch on the rear of the chassis to the NORMAL position and the front panel Mode Selector to the 1-2 position.

On the SD104A-5, set Mode Selector to MAN. position, MULTIPLIER (A) to 1 position and frequency between 4.95 and 5.05 Hz (199 to 201 ms).

CAUTION

Before connecting the ohmmeter in the following steps, remove jumpers installed between A1E17 and A1E18 and between A1E19 and A1E20.

a. Connect DVM with ohmmeter plug-in between A1E18 and A1E20 and install a jumper from A1E21 to either A1E13 or A1E14, depending on which arrangement will allow A1R27 to be adjusted for a 1.1 MΩ (105 to 1.15 MΩ) indication on the ohmmeter. Solder jumper.

b. Set SD104A for 990 to 1010 Hz (0.99 to 101 ms) and then adjust A1R50 for an indication of 2.2 KΩ ±200Ω on the ohmmeter.

c. Set SD104A for 99 to 101 Hz (9.9 to 10.1 ms) and then check ohmmeter for an indication of 10 KΩ, ±5 KΩ.

d. Disconnect ohmmeter between A1E18 and A1E20 and install soldered jumpers between A1E17 and A1E18 and between A1E19 and A1E20.

4.2.4 Integrator Gain

*

a. Set the frequency of the SD104A Sweep Oscillator to 614.5 Hz (1.626 to 1.628 ms) and set the COMPRESSOR switch on the SD105B in the OFF position.

b. On the SD105B, adjust the OUTPUT control for 30 mV rms (29.7 to 30.3 mV rms) at A1TP7 in the SD115A.

c. Adjust A1R12 for 30 mV rms (29.7 to 30.3 mV rms) at A1TP8.

d. Set the frequency of the SD104A Sweep Oscillator to 44.23 Hz (22.60 to 22.62 ms) and adjust A1R54 for 30 mV rms (29.7 to 30.03 mV rms) at A1TP9.

4.2.5 Voltage Follower Check

a. Set the frequency of the SD104A between 400 and 600 Hz. Disconnect DVM ground link for differential input. Measure voltage between A5E17 and A5E21; if it is over 8 mV, replace A5A2.

4.2.6 Crossover Switching/Hysteresis Check

NOTES

1) It is important that the following steps a. through j. be read through before calibration of crossovers is attempted.

2) Each time power is removed for the purpose of soldering a jumper, or changing a resistor or I.C., wait several minutes after power is again applied before making adjustments.

a. On SD104A, set Mode Selector to EXT. position.

b. On SD115A, set crossovers 2-3, 3-4, 4-5 and 5-6 between 3 kHz and 5 kHz.

c. On SD115A, adjust crossover 1-2 between 998 and 1002 Hz.

d. On SD104A, switch Mode Selector to the MAN. position.

e. While observing the Level 1 and 2 indicator lamps on the SD115A, SLOWLY up sweep the frequency of the SD104A through 1 kHz. The Level 2 indicator lamp should light between 995 and 1005 Hz. Before making any adjustment, note the frequency at which it does light and SLOWLY down sweep the SD104A through 1 kHz and note that the Level 1 indicator lamp lights at the frequency previously noted, ±30 Hz. If crossover did not occur between 995 and 1005 Hz while sweeping upwards, proceed with the following step f. If crossover was correct, go to step h.

f. Adjust A3R11 (ZERO ADJUST) for a crossover between 995 and 1005 Hz. If A3R11 has insufficient range, remove the jumper between A3E2 and A3E3 (or E1) and connect it between A3E2 and A3E1 (or E2 if already on E1). Then readjust A3R11 for a crossover between 995 and 1005 Hz. See Note 2) above.

If crossover cannot be adjusted properly with the jumper in either position, do step g.; otherwise continue with step h.

g. Select a value for A3R14 (Factory adjust. Resistor must be one percent or better) that will allow proper adjustment in step f. If the selected value for A3R14 falls below 50k ohms, replace A3A1. After this step g. is completed, begin again with step e. See Note 2) above.

h. On SD104A, switch the Mode Selector to EXT.

i. On SD115A, adjust crossover 1-2 between 400 and 600 Hz.

j. Using the appropriate ±15V jumpers, associated ZERO ADJ potentiometers and factory adjust resistors as tabulated below, perform steps c. through j., as necessary, for crossovers 2-3, 3-4, 4-5 and 5-6.

Table 4-2. Crossover Adjustment Components

Crossover	Zero Adjust	Jumper Terminals	Factory Adjust	I.C.
1-2	A3R11	A3E2 to A3E3 or 1	A3R14	A3A1
2-3	A3R37	A3E5 to A3E6 or 4	A3R40	A3A2
3-4	A3R65	A3E8 to A3E9 or 7	A3R68	A3A3
4-5	A3R92	A3E11 to A3E12 or 10	A3R95	A3A4
5-6	A3R119	A3E14 to A3E15 or 13	A3R122	A3A5

4.2.7 Null Detector Gain

a. Remove jumpers between A5E1 and A5E2 and between A5E3 and A5E4.

b. Jumper A5E2 to A5E4. Connect an RMS voltmeter and a signal generator (the variable output of the SD104A routed through the H-P 350D Attenuator may be used) to A5E2 and A5E4. Adjust input signal for 10 mV rms ±5 mV rms at 1 kHz. Adjust A5R11 for a centerline indication on the NULL meter. *→

c. Install permanent jumpers between A5E1 and A5E2 and between A5E3 and A5E4.

4.2.8 Amplifier Gain Adjust

a. Connect RMS voltmeter and oscilloscope to A2E2. Set Mode Selector in CROSSOVER ADJUST 1-2 position and A-V-D Range controls 1 and 2 in the 1g position. Temporarily disconnect cable at J5 on the rear of the SD115A and apply instead to J5 the variable amplitude sine wave signal from the SD104A (J22); adjust the level of the signal for 3 mV rms (2.97 to 3.03 mV rms) clean sine wave.

b. Connect RMS voltmeter and oscilloscope A2E21. Adjust A2R53 for a 300 mV rms (297 to 303 mV rms) clean sine wave.

c. Switch the Mode Selector to the PRESET LEVEL 1 position and adjust the SD104A OUTPUT LEVEL control for 300 mV rms (297 to 303 mV rms) at A2E21.

d. Switch the Mode Selector through PRESET LEVEL positions 2 through 6. The signal level at A2E21 should not vary by more than 3% or 0.3 dB.

e. Restore normal cable connection from J33 of SD105B to J5 of SD115A.

4.2.9 Operational Check

a. Disconnect power cord from primary power source. Visually inspect the SD115A, and replace top and bottom covers.

b. Reconnect power and place instrument in service. To ensure proper calibration and overall performance, complete the operational checkout presented in paragraph 2.2, Section II, of this manual.

4.3 PARTS REPLACEMENT

Except for some special SDC specification-controlled parts listed in Table 4-3 which must be ordered from Spectral Dynamics Corporation, standard electronic parts have been used throughout the instrument. Spectral Dynamics Corporation maintains a complete stock of all parts and complete printed circuit card assemblies used in the instrument.

When ordering a replacement part or assembly, be sure to include the reference designation, the part number or manufacturer's designation, and a complete description; include also the instrument name, model number, and serial number.

Table 4-3. Special Replaceable Parts List

Reference Designator	Description	Part Number Mfr. Designation
A1	A-V-D Input Assembly	11206-1
A2	Buffer/Amplifier Assembly	11212-1
A3	Crossover Switching Assembly	11216-1
*→ A4	Transfer Switching Assembly	14844-4
A5	Null Detector Assembly	11208-1
A6	Power Supply Assembly	11420-1
DS1–DS6	Lamp, A-V-D Indicator	CF03-WTS-2102
DS7	Lamp, PRESET Indicator	CF03-YTS-2102
	Knob, BYPASS/NORMAL	20013-175
	Knob, A-V-D Range (Large)	20013-176
	Knob, LEVEL Control (Small)	20013-177
M1	Meter, NULL	20013-228
P8	Plug, AUX FUNCTIONS	SK-19-21C1/2
A1A2	Photo Cell Assembly	10292-1
S1–S6	Switch, A-V-D Range	20013-201
S7	Switch, Mode	20013-363
S8	Switch, BYPASS/NORMAL	20013-216
S9	Switch, 115/230	46256LF
T1	Transformer, Power	20013-200
---	Cord, Power	Belden 17258-S

*Revised (2-17-72)

≈ 36V

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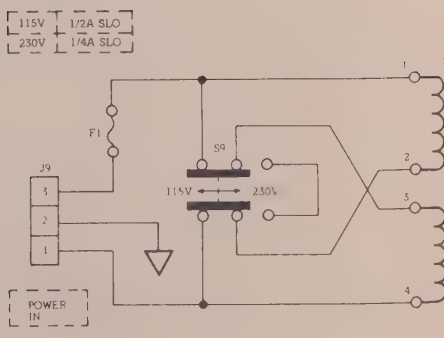
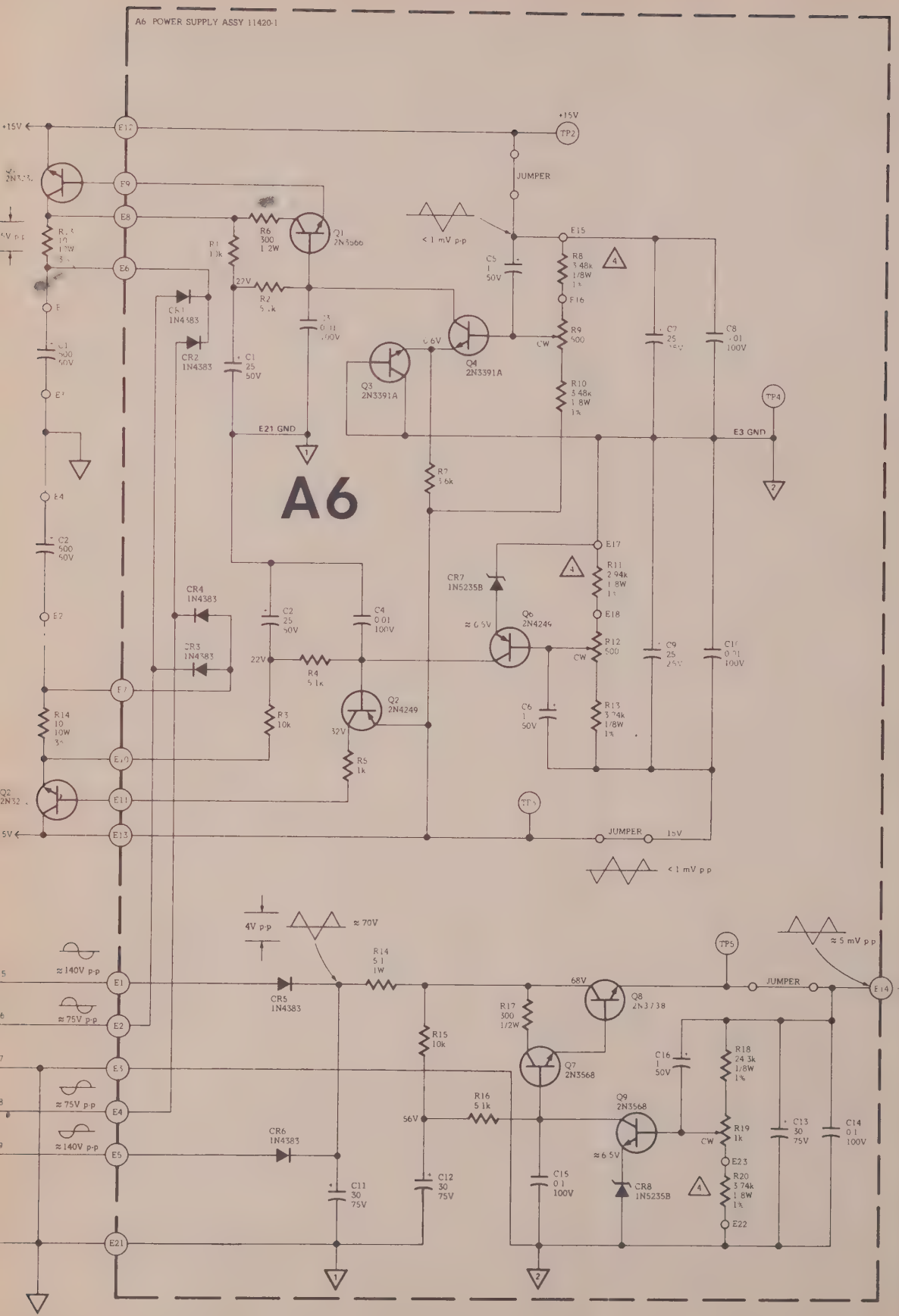
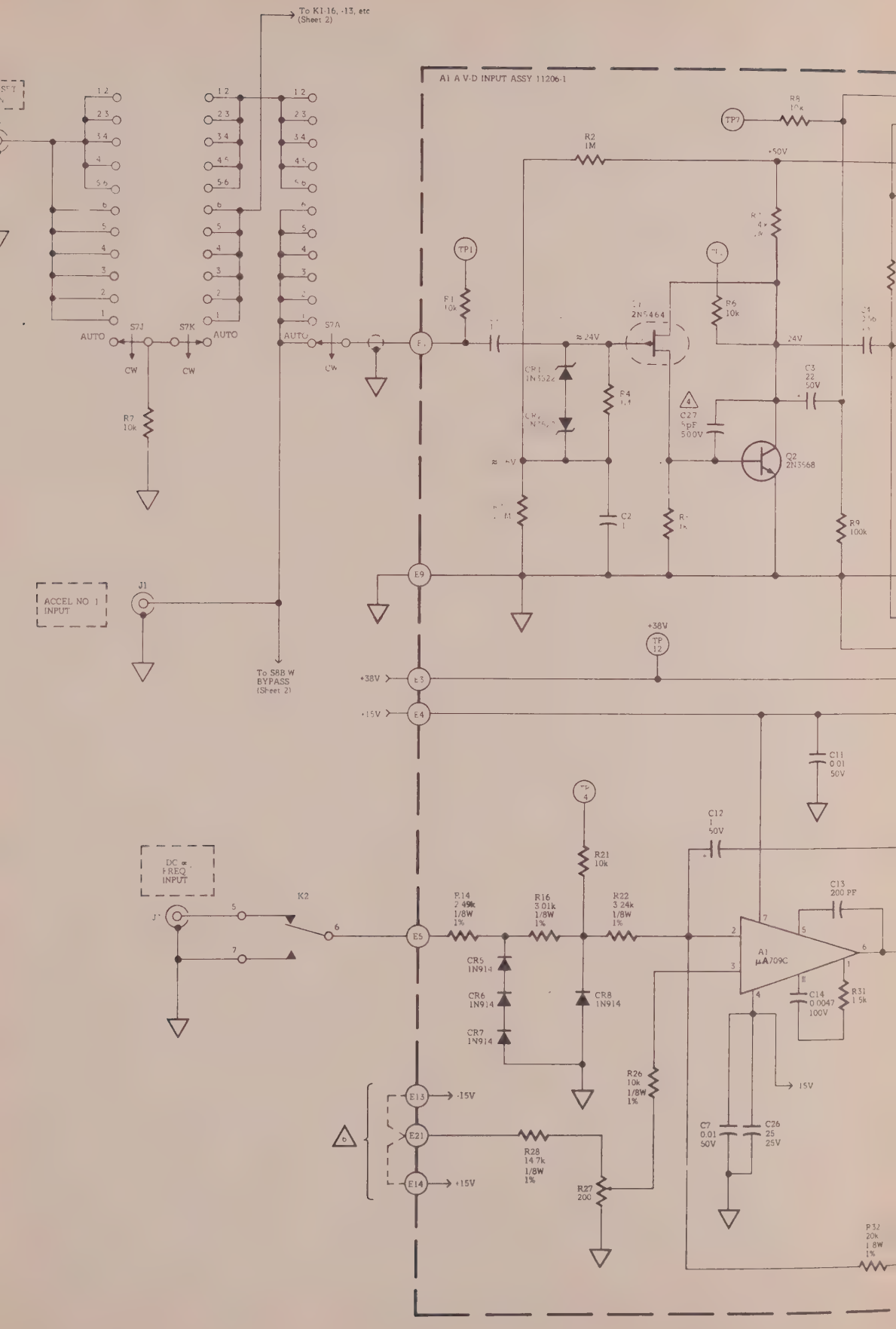
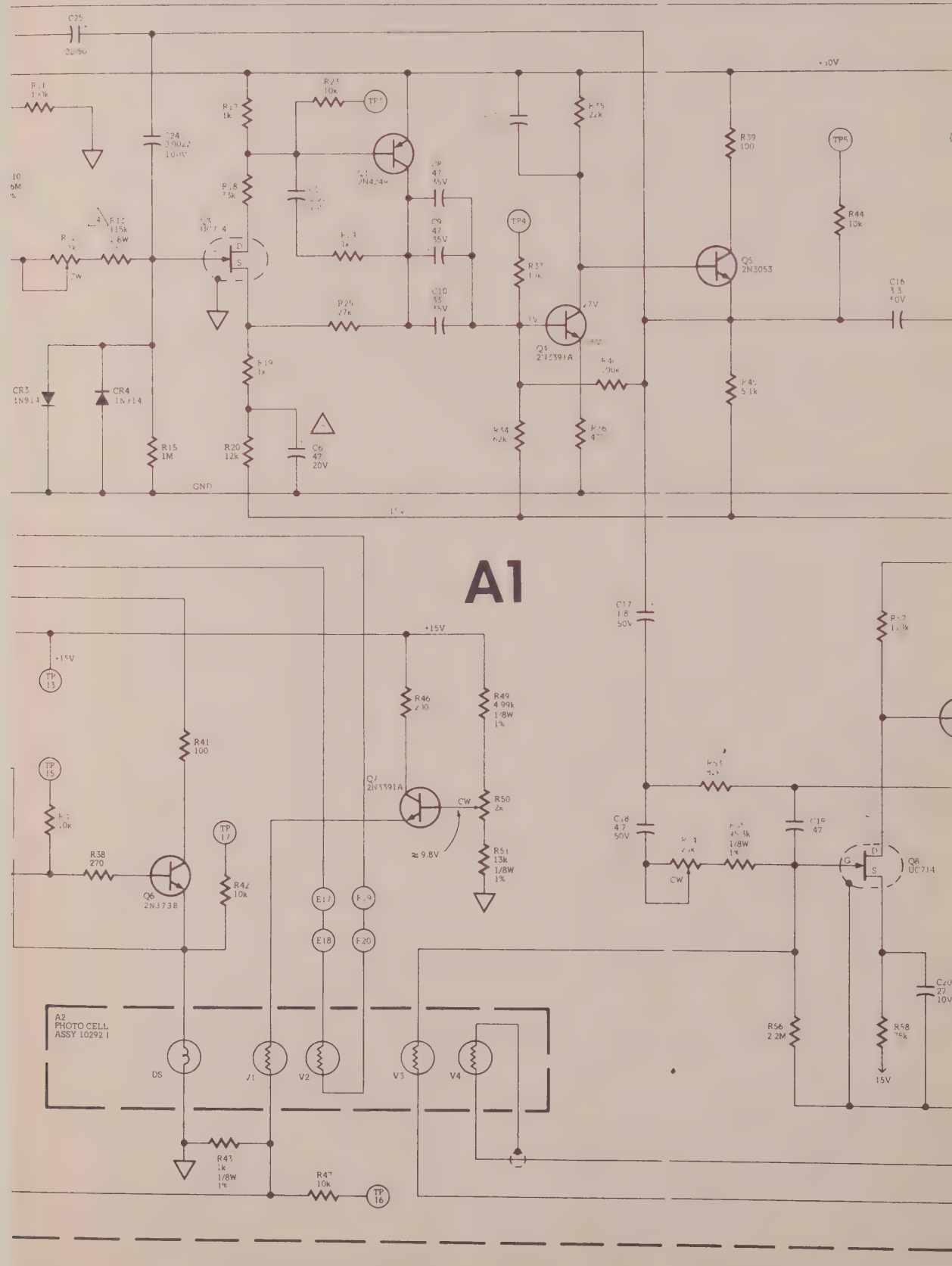
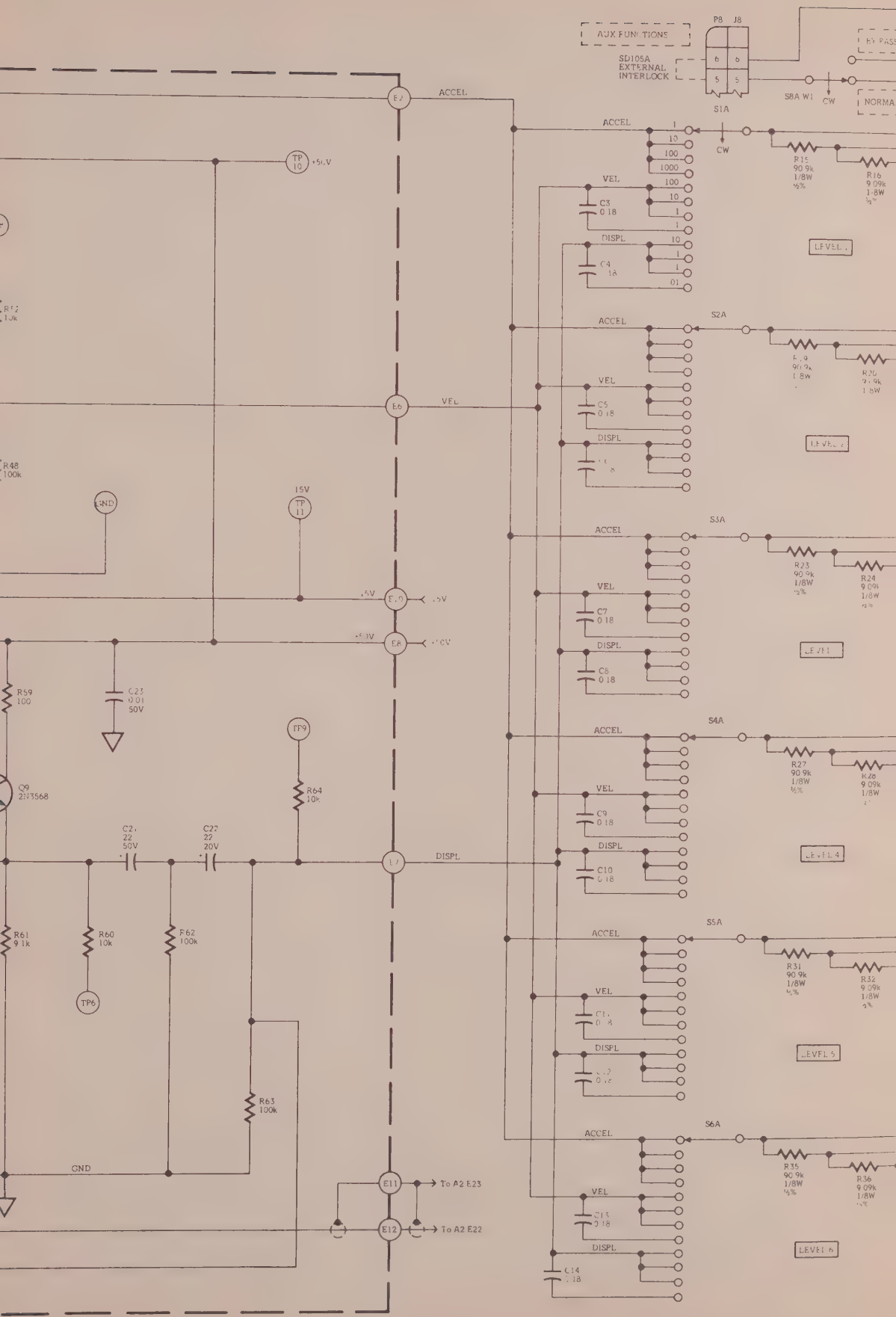
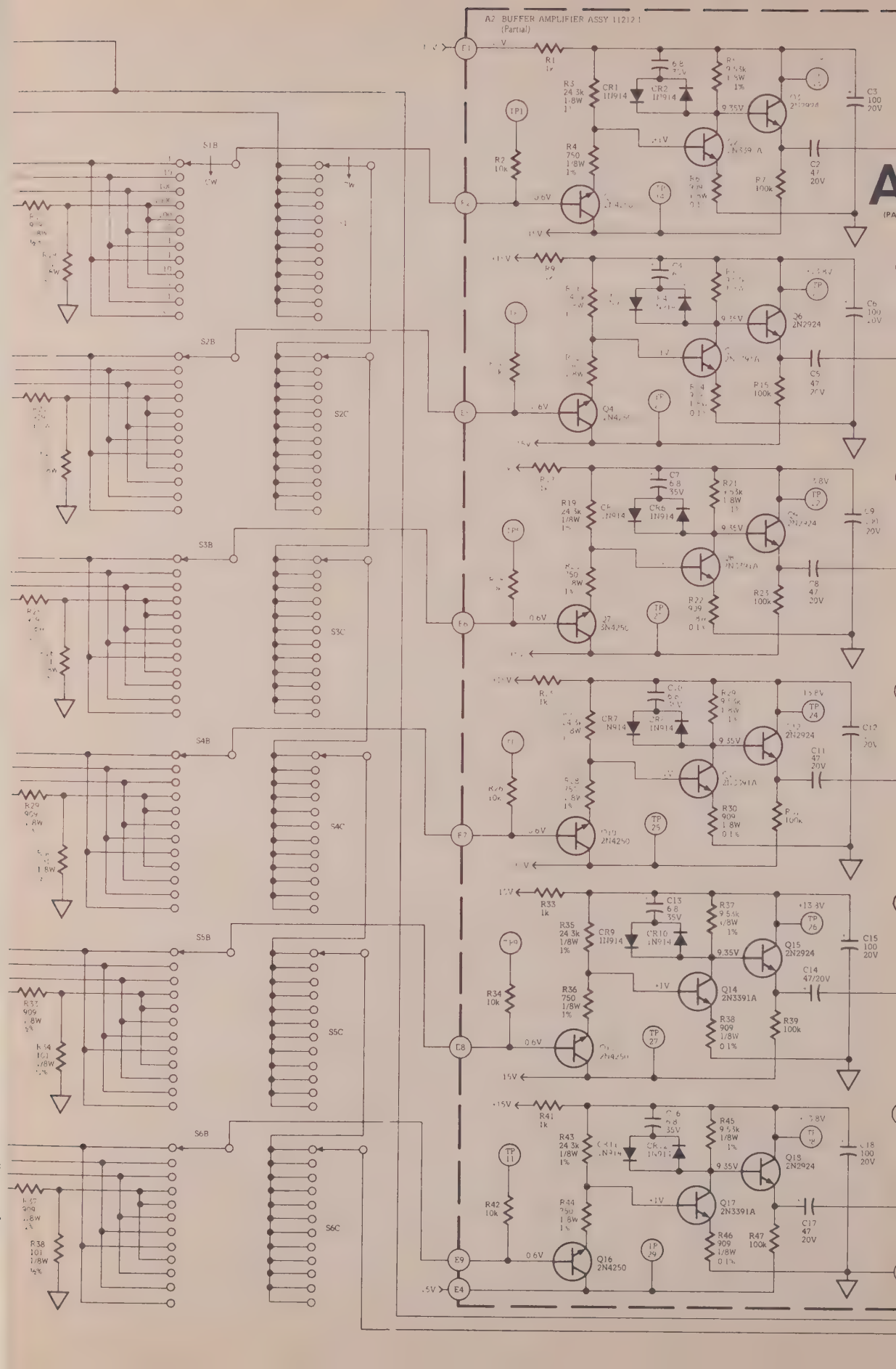



A6 POWER SUPPLY ASSY 11420-1
A6
+15V
TP2
JUMPER
E15
< 1 mV p-p
C5
1
50V
R8
3.48k
1/8W
1%
4
F16
R9
500
CW
C7
25
C8
.01
100V
R10
3.48k
1.8W
1%
TP4
E3 GND
Q4
2N3391A
Q3
2N3391A
6V
R1
10k
R6
300
1.2W
Q1
2N3566
22V
R2
5.1k
CR1
1N4383
CR2
1N4383
C1
25
50V
E21 GND
R7
5.6k
E17
CR7
1N5235B
R11
2.94k
1.8W
1%
E18
≈ 6.5V
Q6
2N4249
R12
500
CW
C9
25
C10
.01
100V
CR4
1N4383
CR3
1N4383
C2
25
50V
C4
0.01
100V
22V
R4
5.1k
R3
10k
Q2
2N4249
32V
R5
1k
C6
1
50V
R13
3.74k
1/8W
1%
R14
10
10W
JUMPER
15V
< 1 mV p-p
4V p-p
≈ 70V
R14
5.1
1W
CR5
1N4383
≈ 140V p-p
≈ 75V p-p
≈ 75V p-p
≈ 140V p-p
68V
Q8
2N3738
R17
300
1/2W
Q7
2N3568
R15
10k
R16
5.1k
56V
Q9
2N3568
≈ 6.5V
CR8
1N5235B
CR6
1N4383
C11
30
75V
C12
30
75V
C15
0.1
100V
C16
1
50V
R18
24.3k
1/8W
1%
R19
1k
CW
E23
R20
3.74k
1.8W
1%
E22
C13
30
75V
C14
0.1
100V
TP5
≈ 5 mV p-p
JUMPER
E14
E21


To K1-16, -13, etc (Sheet 2)
A1 A V-D INPUT ASSY 11206-1
S7J
S7K
S7A
AUTO
CW
R7 10k
ACCEL NO 1 INPUT
J1
To S8B W BYPASS (Sheet 2)
TP7
R8 10k
R2 1M
+50V
TP1
R1 10k
R6 10k
2N5464
≈24V
24V
CR1 1N3522
R4
C3 22 50V
C27 5pF 500V
Q2 2N3568
≈ +V
C2 1
R9 100k
E9
+38V
TP 12
E3
+15V
E4
C11 0.01 50V
DC or FREQ INPUT
K2
J
E5
R14 2.49k 1/8W 1%
R16 3.01k 1/8W 1%
R22 3.24k 1/8W 1%
R21 10k
C12 1 50V
C13 200 PF
A1 μA709C
CR5 1N914
CR6 1N914
CR7 1N914
CR8 1N914
C14 0.0047 100V
R31 1.5k
R26 10k 1/8W 1%
15V
E13
-15V
E21
E14
+15V
R28 14.7k 1/8W 1%
R27 200
C7 0.01 50V
C26 25 25V
R32 20k 1/8W 1%


A1
C25
R1
R24
R17
R18
R23
TP7
2N4340
R25
C8
47
35V
C9
47
35V
C10
33
35V
R19
C6
47
20V
CR3
1N914
CR4
1N914
R15
1M
R20
12k
GND
R37
Q1
2N2391A
R34
62k
R35
47
R36
100k
R39
100
R40
5.1k
Q5
2N3053
TP5
R44
10k
C16
3.3
50V
+10V
+15V
TP13
R41
100
TP15
R38
270
Q6
2N3738
TP17
R42
10k
R46
270
R49
4.99k
1/8W
1%
Q7
2N3391A
CW
R50
2k
R51
13k
1/8W
1%
≈ 9.8V
E17
E18
E19
E20
A2
PHOTO CELL
ASSY 10292 1
DS
J1
V2
V3
V4
R43
1k
1/8W
1%
R47
10k
TP16
C17
1.8
50V
R53
C18
4.7
50V
R54
2k
CW
R55
25.5k
1/8W
1%
C19
47
Q8
UC714
R56
2.2M
R58
15V
C20
27
10V


AUX FUNCTIONS
SD105A EXTERNAL INTERLOCK
P8 J8
S8A W1
CW
NORMA
E2
ACCEL
TP 10
+5V
S1A
ACCEL
1
10
100
1000
CW
R15 90.9k 1/8W
R16 9.09k 1/8W
VEL
100
10
1
.1
C3 0.18
DISPL
10
1
.1
.01
C4 .18
LEVEL 1
S2A
ACCEL
R19 90.9k 1/8W
R20 9.09k 1/8W
E6
VEL
C5 0.18
DISPL
LEVEL 2
15V
TP 11
GND
R48 100k
S3A
ACCEL
R23 90.9k 1/8W
R24 9.09k 1/8W
VEL
C7 0.18
DISPL
C8 0.18
LEVEL 3
+5V
+5V
+15V
+15V
R59 100
C23 0.01 50V
S4A
ACCEL
R27 90.9k 1/8W
R28 9.09k 1/8W
TP9
R64 10k
Q9 2N3568
VEL
C9 0.18
DISPL
C10 0.18
LEVEL 4
C21 22 50V
C22 22 20V
E7
DISPL
S5A
ACCEL
R31 90.9k 1/8W
R32 9.09k 1/8W
R61 9.1k
R60 10k
R62 100k
TP6
VEL
C11 0.18
DISPL
C12 0.18
LEVEL 5
R63 100k
S6A
ACCEL
R35 90.9k 1/8W
R36 9.09k 1/8W
GND
E11
To A2 E23
VEL
C13 0.18
E12
To A2 E22
DISPL
C14 0.18
LEVEL 6


A2 BUFFER AMPLIFIER ASSY 11212 1
(Partial)
S1B
S2B
S2C
S3B
S3C
S4B
S4C
S5B
S5C
S6B
S6C
E1
E2
E3
E6
E7
E8
E9
E4
TP1
TP 23
TP 24
TP 25
TP 26
TP 27
TP 11
TP 29
R1
R2 10k
R3 24.3k 1/8W 1%
R4 750 1/8W 1%
R5
R6
R7 100k
R9
R10
R11
R12
R13
R15 100k
R19 24.3k 1/8W 1%
R20 750 1/8W 1%
R21 9.53k 1/8W 1%
R22 909 1/8W 0.1%
R23 100k
R25 1k
R26 10k
R27
R28
R29 9.53k 1/8W 1%
R30 909 1/8W 0.1%
R31
R33 1k
R34 10k
R35 24.3k 1/8W 1%
R36 750 1/8W 1%
R37 9.53k 1/8W 1%
R38 909 1/8W 0.1%
R39 100k
R41 1k
R42 10k
R43 24.3k 1/8W 1%
R44 750 1/8W 1%
R45 9.53k 1/8W 1%
R46 909 1/8W 0.1%
R47 100k
CR1 1N914
CR2 1N914
CR5 1N914
CR6 1N914
CR7 1N914
CR8 1N914
CR9 1N914
CR10 1N914
CR11 1N914
CR12 1N914
C1
C2 47 20V
C3 100 20V
C4
C5 47 20V
C6 100 20V
C7 6.8 35V
C8 47 20V
C9 20V
C10
C11 47 20V
C12 20V
C13 6.8 35V
C14 47/20V
C15 100 20V
C16
C17 47 20V
C18 100 20V
Q1 2N2924
Q2 2N3391A
Q3 2N4250
Q4 2N4250
Q5 2N2924
Q6 2N3391A
Q7 2N4250
Q8
Q9 2N4250
Q10
Q11 2N2924
Q12 2N3391A
Q13 2N4250
Q14 2N3391A
Q15 2N2924
Q16 2N4250
Q17 2N3391A
Q18 2N2924
+15V
-15V
+13.3V
+1V
0.6V
9.35V
A
(PA

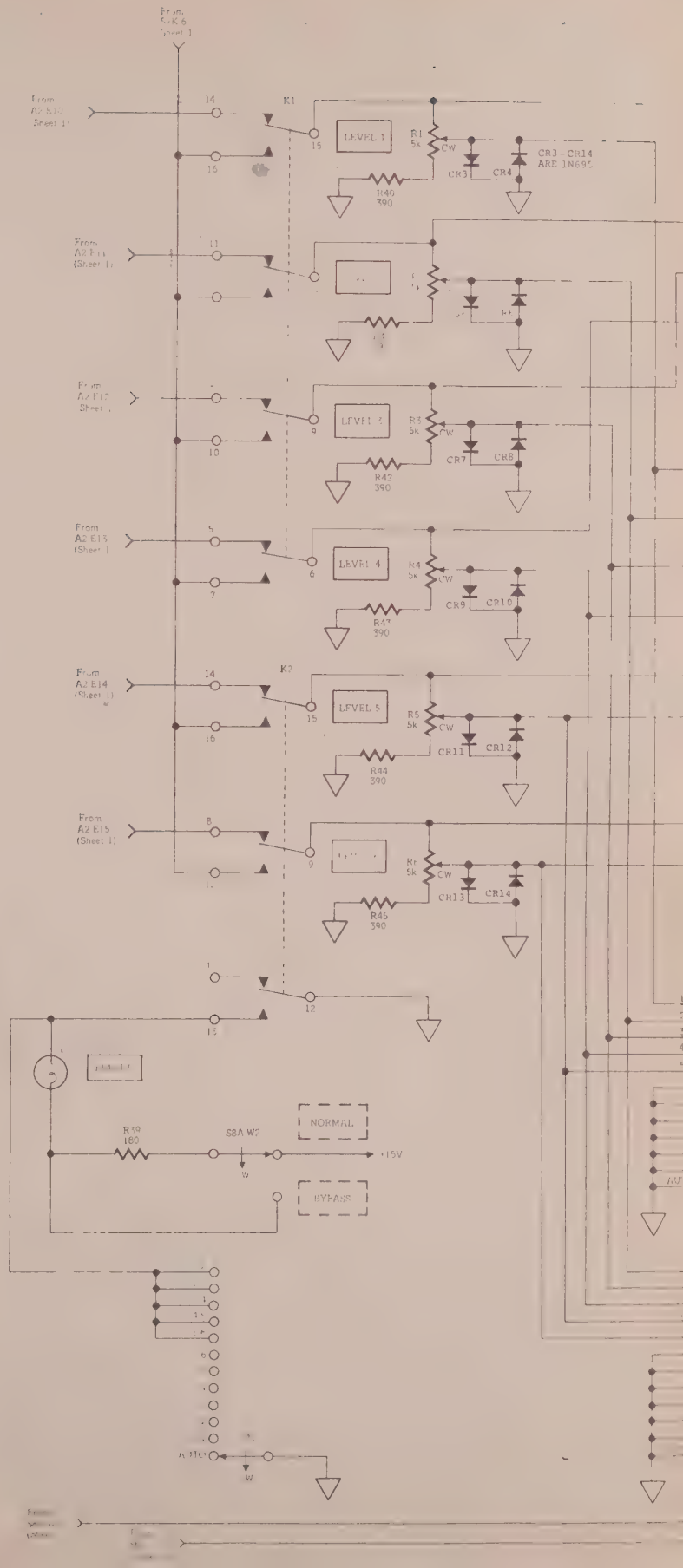
REVISIONS						
LTR	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APP'D
A		011	Released			
B	524	011	Wiring change to S7D. Changed value of A3R142 thru A3R147 & R39			
C	536	011	Added R47; Changed value of A1R10 & A1C6. Deleted A6R21, A6R22, A6E19 & A6E20			
D	545	011	Redrawn. Changed value of A1R13, A2R52, A5C13, A5C14 & R40 thru R45, Changed A4Q1 thru A4Q12 to type U1897. Multiple tolerance changes to resistors on ckt card A3. LEVEL 1 6 indicator lamps designated DS1 DS6. Capacitors A3C2, C6, C10, C14, and C18 changed to 0 0047	8/68		
E	569	021	Changed value of A5C15 & A5C16 to 150 @ 15V. Added A3E22, A3E23 & A3E24	10/68		
F			A1Q6 & A6Q8 was 41422.			
G	625 636 637	011 021 34740 4360N	A1CR3 & A1CR4 was 1N6 . A5C9 was 50%. R47 w . A1R12 was 20K. Add			
H	642	085	A4R26 & A4R28 was 5K, 5%			
J	841	96	DELETED R47; CHANGED R7 TO FIXED RESISTOR TYPE (10k); CONNECTED WIPER OF S7J TO WIPER OF S7K. ESTABLISHED MODEL SD115A.	G.C.	8/70	
K	878	096	ADDED A5CR8.	D.S. 2/72		
L	918	011	ADDED A1C27.	D.S. 2/72		
M	1038	011	CIRCUIT CARD A4 CHANGED FROM ASSY.11214-1 TO ASSY.14844-3; ADDED DIODES CR3-CR14 TO WIPERS OF CONTROLS R1 THRU R6.	D.S. 2/72		

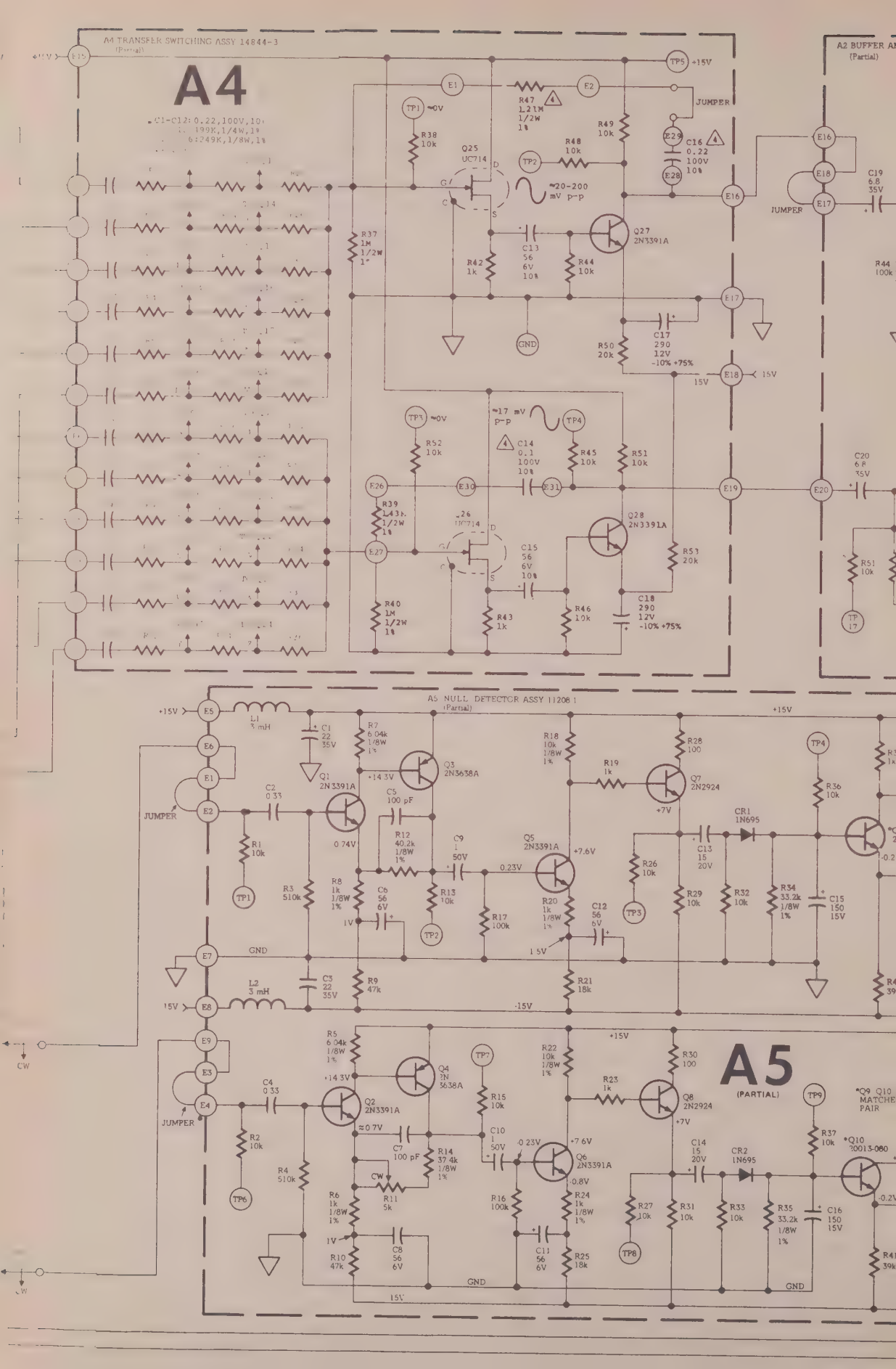
NOTES

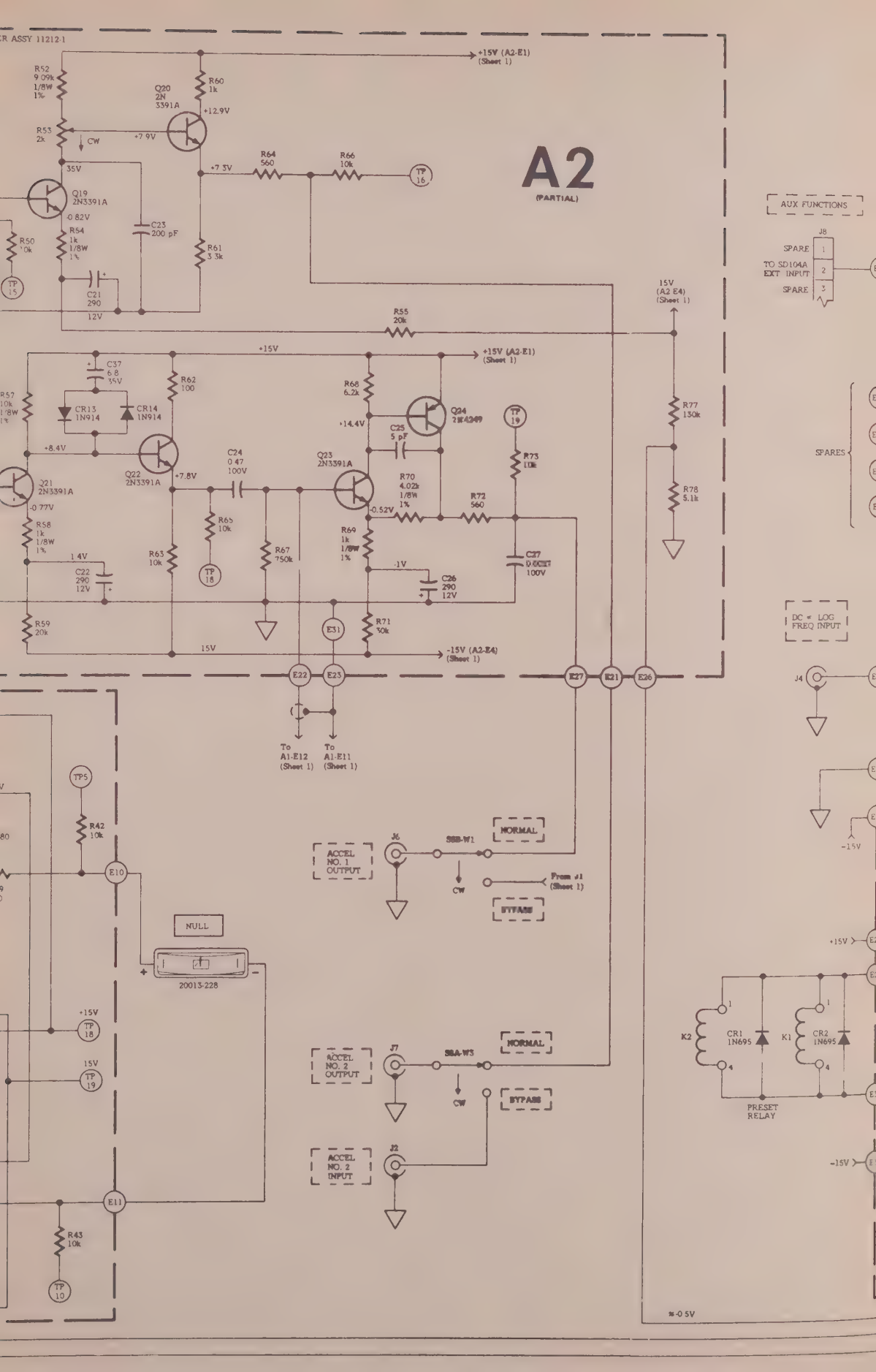
1 UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS ¼W. 5%. ALL CAPACITANCE IN MICROFARDS 200V ±10

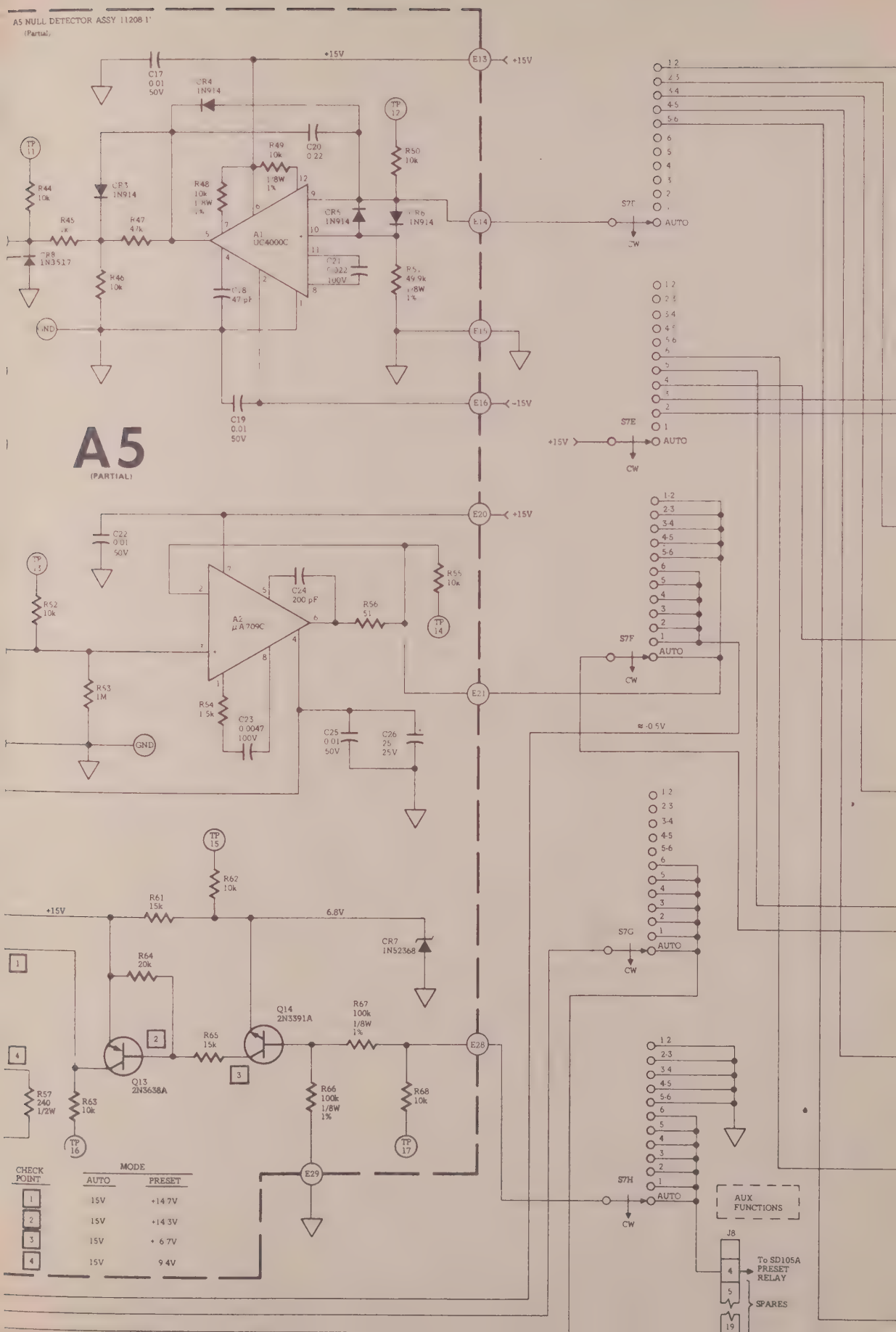
2 SYMBOL ▭ INDICATES FRONT PANEL LOCATION

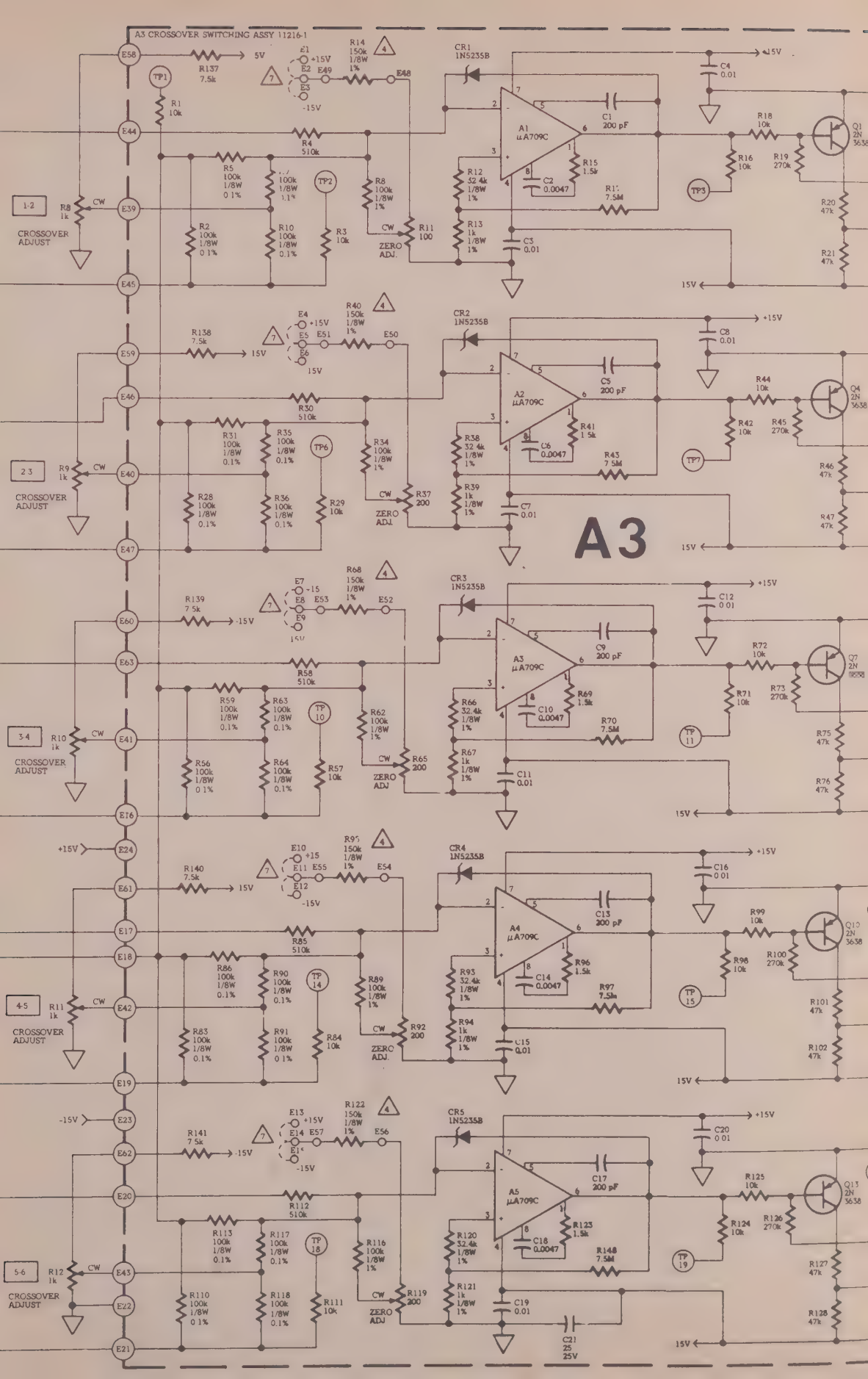
3 SYMBOL ⊏⊐⊐⊐

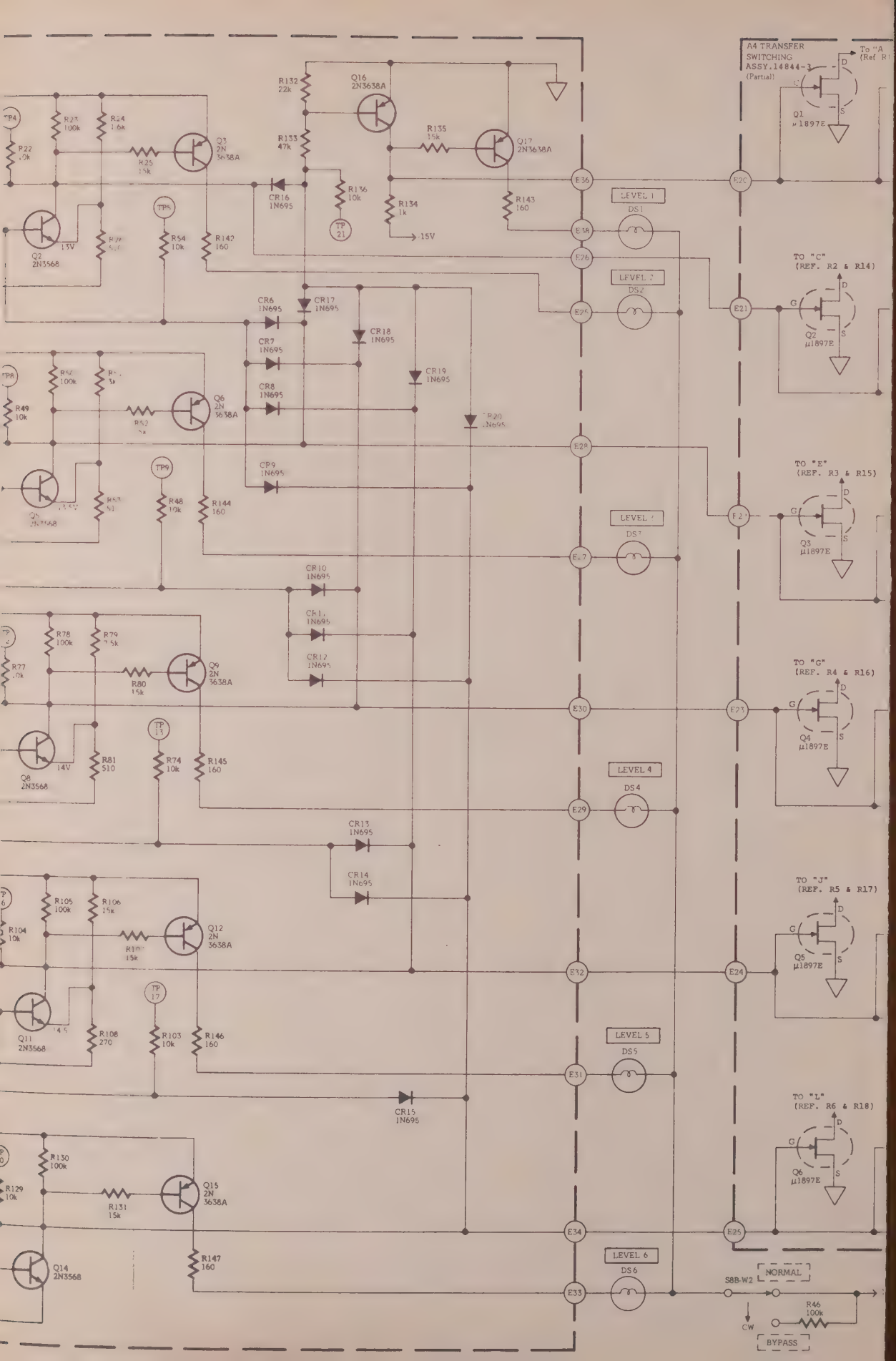

K1
LEVEL 1
R1
5k
CW
CR3
CR4
CR3 - CR14
ARE 1N695
R40
390
LEVEL 3
R3
5k
CR7
CR8
R42
390
LEVEL 4
R4
5k
CR9
CR10
R43
390
K2
LEVEL 5
R5
5k
CR11
CR12
R44
390
R6
5k
CR13
CR14
R45
390
R19
180
S8A W2
NORMAL
+15V
BYPASS

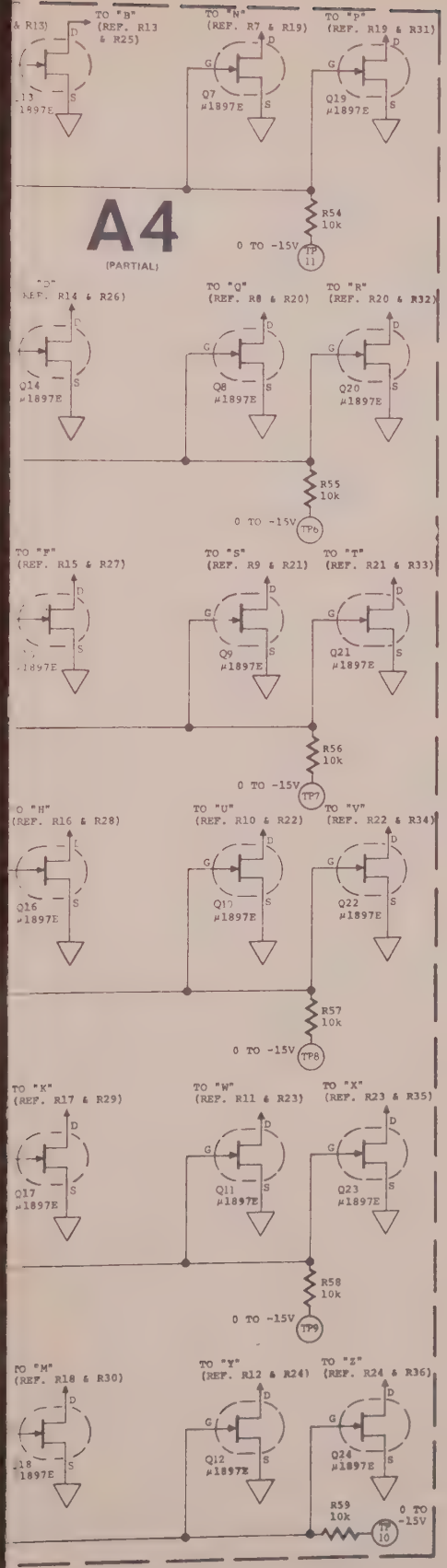

A4
A4 TRANSFER SWITCHING ASSY 14844-3
(Partial)
A2 BUFFER AM
(Partial)
A5 NULL DETECTOR ASSY 11208-1
(Partial)
A5
(PARTIAL)
JUMPER
GND
+15V
-15V
15V
CW
Q25 UC714
Q27 2N3391A
Q28 2N3391A
Q1 2N3391A
Q2 2N3391A
Q3 2N3638A
Q4 2N 5638A
Q5 2N3391A
Q6 2N3391A
Q7 2N2924
Q8 2N2924
CR1 1N695
CR2 1N695
*Q9 Q10 MATCHED PAIR
*Q10 20013-060
~20-200 mV p-p
~17 mV p-p
~0V
+14.3V
+7V
+7.6V
0.74V
0.23V
1V
1.5V
-0.8V
-0.2V


A2
(PARTIAL)
ER ASSY 11212-1
+15V (A2-E1)
(Sheet 1)
R52
9.09k
1/8W
1%
R53
2k
CW
Q20
2N
3391A
R60
1k
+12.9V
+7.9V
35V
Q19
2N3391A
-0.82V
R54
1k
1/8W
1%
C23
200 pF
R61
3.3k
R64
560
R66
10k
TP
16
+7.5V
R50
10k
TP
15
C21
290
12V
R55
20k
15V
(A2-E4)
(Sheet 1)
+15V
+15V (A2-E1)
(Sheet 1)
C37
6.8
35V
R62
100
R68
6.2k
CR13
1N914
CR14
1N914
+14.4V
C25
5 pF
Q24
2N4249
TP
19
R77
130k
+8.4V
Q22
2N3391A
+7.8V
C24
0.47
100V
Q23
2N3391A
R73
10k
Q21
2N3391A
-0.77V
R70
4.02k
1/8W
1%
-0.52V
R72
560
R78
5.1k
R58
1k
1/8W
1%
1.4V
R65
10k
R63
10k
TP
18
R67
750k
R69
1k
1/8W
1%
-1V
C27
0.001
100V
C22
290
12V
C26
290
12V
R59
20k
E31
R71
50k
15V
-15V (A2-E4)
(Sheet 1)
E22
E23
E27
E21
E26
To
A1-E12
(Sheet 1)
To
A1-E11
(Sheet 1)
AUX FUNCTIONS
J8
SPARE
1
TO SD104A
EXT INPUT
2
SPARE
3
SPARES
DC = LOG
FREQ INPUT
J4
-15V
TP5
R42
10k
E10
ACCEL
NO. 1
OUTPUT
J6
SBB-W1
NORMAL
CW
From J1
(Sheet 1)
BYPASS
NULL
20013-228
+15V
TP
18
15V
TP
19
ACCEL
NO. 2
OUTPUT
J7
SBA-W3
NORMAL
CW
BYPASS
ACCEL
NO. 2
INPUT
J2
E11
R43
10k
TP
10
+15V
K2
CR1
1N695
K1
CR2
1N695
PRESET
RELAY
-15V
-0.5V


A5 NULL DETECTOR ASSY 11208-1
(Partial)
A5
(PARTIAL)
+15V
-15V
GND
E13
E14
E15
E16
E20
E21
E28
E29
C17 0.01 50V
C19 0.01 50V
C22 0.01 50V
C23 0.0047 100V
C24 200 pF
C25 0.01 50V
C26 25 25V
CR3 1N914
CR4 1N914
CR5 1N914
CR6 1N914
CR7 1N52368
CR8 1N3517
R44 10k
R45 1k
R46 10k
R47 47k
R48 10k 1%
R49 10k 1/8W 1%
R50 10k
R51 49.9k 1/8W 1%
R52 10k
R53 1M
R54 1.5k
R55 10k
R56 51
R57 240 1/2W
R61 15k
R62 10k
R63 10k
R64 20k
R65 15k
R66 100k 1/8W 1%
R67 100k 1/8W 1%
R68 10k
A1 UC4000C
A2 µA709C
Q13 2N3638A
Q14 2N3391A
TP 11
TP 12
TP 13
TP 14
TP 15
TP 16
TP 17
S7E
S7F
S7G
S7H
AUTO
CW
1-2
2-3
3-4
4-5
5-6
≈ -0.5V
6.8V
AUX FUNCTIONS
J8
To SD105A PRESET RELAY
SPARES
CHECK POINT
MODE
AUTO
PRESET
1 15V +14.7V
2 15V +14.3V
3 15V +6.7V
4 15V 9.4V


A3 CROSSOVER SWITCHING ASSY 11216-1
A3
CR1 1N5235B
CR2 1N5235B
CR3 1N5235B
CR4 1N5235B
CR5 1N5235B
A1 µA709C
A2 µA709C
A3 µA709C
A4 µA709C
A5 µA709C
CROSSOVER ADJUST
ZERO ADJ.
+15V
-15V
5V
15V


A4 TRANSFER SWITCHING ASSY.14844-3 (Partial)
To "A" (Ref R
Q1 μ1897E
TO "C" (REF. R2 & R14)
Q2 μ1897E
TO "E" (REF. R3 & R15)
Q3 μ1897E
TO "G" (REF. R4 & R16)
Q4 μ1897E
TO "J" (REF. R5 & R17)
Q5 μ1897E
TO "L" (REF. R6 & R18)
Q6 μ1897E
R132 22k
Q16 2N3638A
R133 47k
R135 15k
Q17 2N3638A
CR16 1N695
R136 10k
TP 21
R134 1k
15V
R143 160
E36
E35
E26
E21
E20
LEVEL 1
DS1
LEVEL 2
DS2
R22 10k
R23 100k
R24 1.6k
R25 15k
Q3 2N 3638A
13V
Q2 2N3568
TP5
R54 10k
R142 160
CR6 1N695
CR17 1N695
CR7 1N695
CR8 1N695
CR18 1N695
CR19 1N695
CR20 1N695
R49 10k
Q6 2N 3638A
E28
TP9
R48 10k
R144 160
CR9 1N695
LEVEL 3
DS3
E27
E22
CR10 1N695
CR11 1N695
CR12 1N695
R77 10k
R78 100k
R79 7.5k
R80 15k
Q9 2N 3638A
Q8 2N3568
14V
R81 510
TP 13
R74 10k
R145 160
E30
E23
LEVEL 4
DS4
E29
CR13 1N695
CR14 1N695
R104 10k
R105 100k
R106 15k
Q12 2N 3638A
Q11 2N3568
R108 270
TP 17
R103 10k
R146 160
E32
E24
LEVEL 5
DS5
E31
CR15 1N695
R129 10k
R130 100k
R131 15k
Q15 2N 3638A
Q14 2N3568
R147 160
E34
E25
LEVEL 6
DS6
E33
S8B-W2
NORMAL
CW
R46 100k
BYPASS



NOTES & REVISIONS: See Sheet 1.

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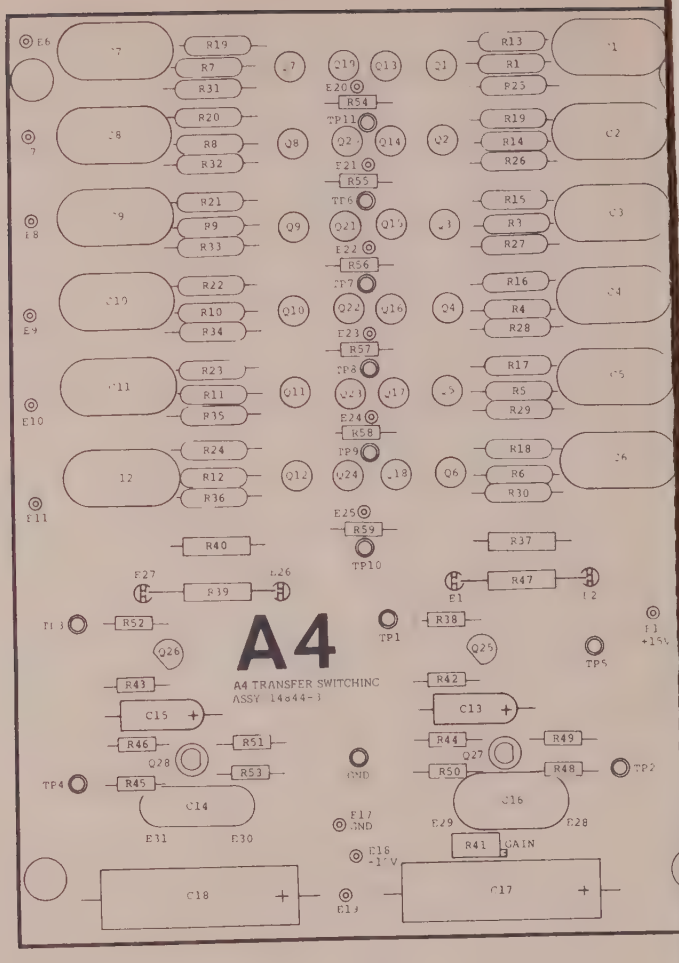
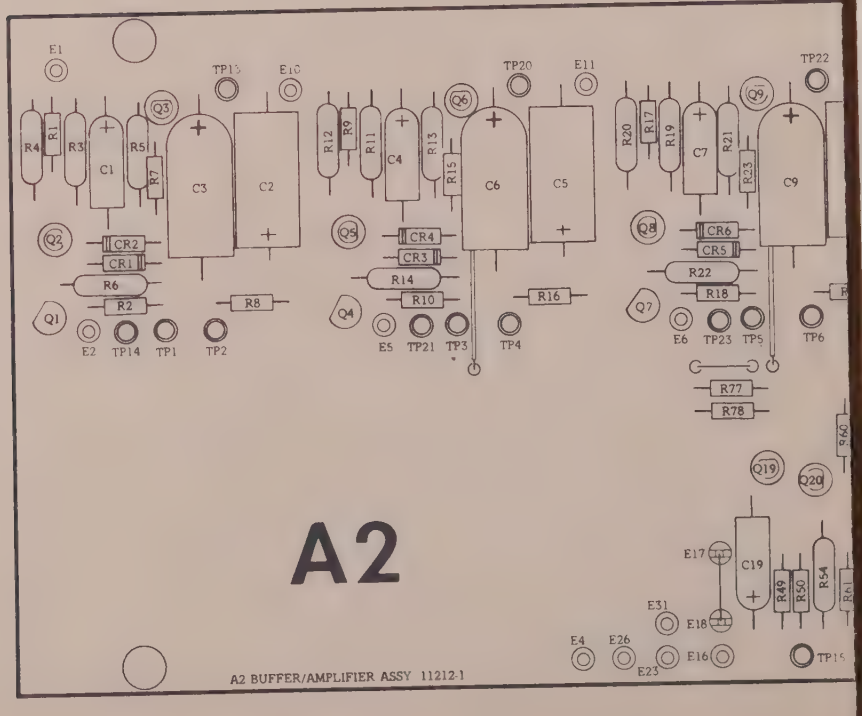
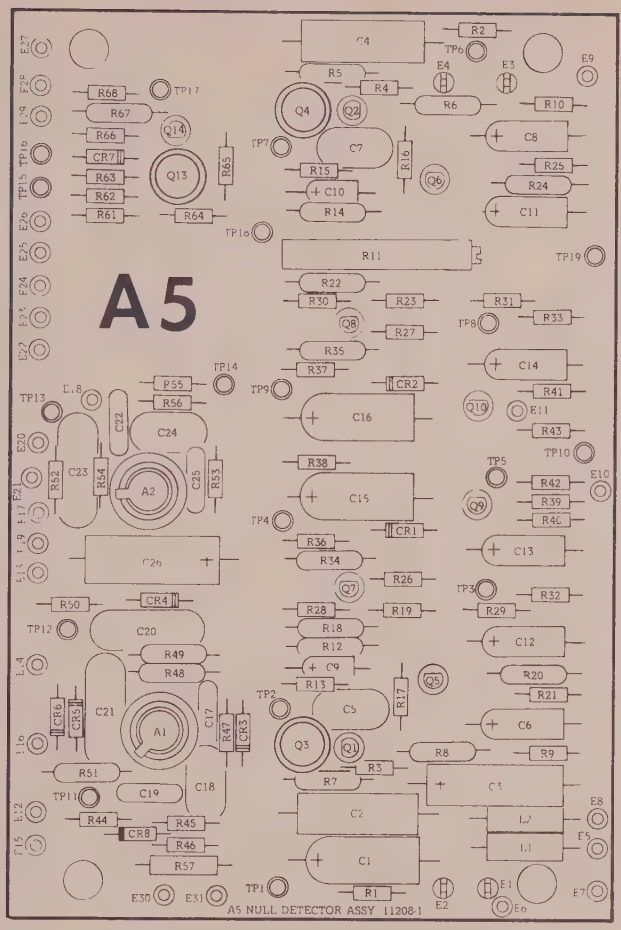
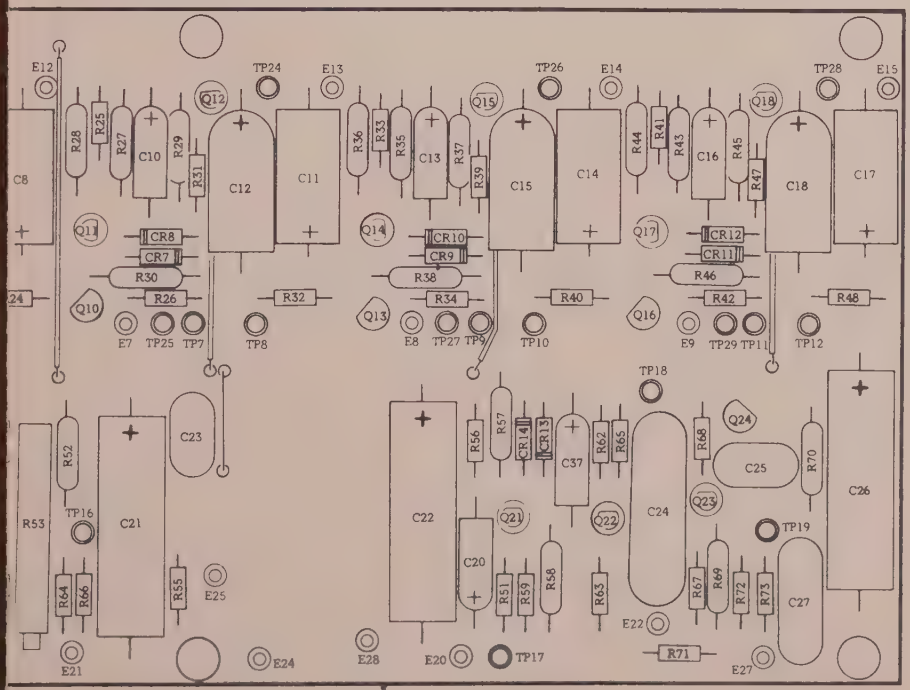
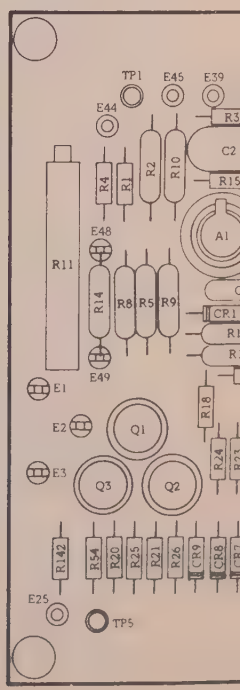
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO		TITLE: SCHEMATIC/COMPONENT LAYOUT— MODEL SD115A AUTOMATIC LEVEL PROGRAMMER		
DRAWN	G. Clare 10-1-68		SIZE	REV
CHECKED	D. Ford 10-2-68	DRAWING NO 11479		M
ENGINEER	10-3-68			
APPROVED	10-7-68	SCALE	SHEET 2 OF 5	


A4
A4 TRANSFER SWITCHING
ASSY 14844-3
R19
R7
R31
R20
R8
R32
R21
R9
R33
R22
R10
R34
R23
R11
R35
R24
R12
R36
R13
R1
R25
R14
R26
R15
R3
R27
R16
R4
R28
R17
R5
R29
R18
R6
R30
R40
R37
R39
R47
R52
R38
R43
R42
C15
C13
R46
R51
R44
R49
Q28
R53
Q27
R50
R48
R45
C14
C16
R41
GAIN
C18
C17
TP1
TP2
TP4
TP5
TP9
TP10
TP11
GND


A2
A2 BUFFER/AMPLIFIER ASSY 11212-1
R4
R1
R3
C1
R5
R7
C3
C2
R12
R9
R11
C4
R13
R15
C6
C5
R20
R17
R19
C7
R21
R23
C9
R6
R2
R8
R14
R10
R16
R22
R18
CR1
CR2
CR3
CR4
CR5
CR6
R77
R78
C19
R49
R50
R54
TP14
TP1
TP2
TP21
TP3
TP4
TP23
TP5
TP6
TP15
TP20
TP22


A5
A5 NULL DETECTOR ASSY 11208-1





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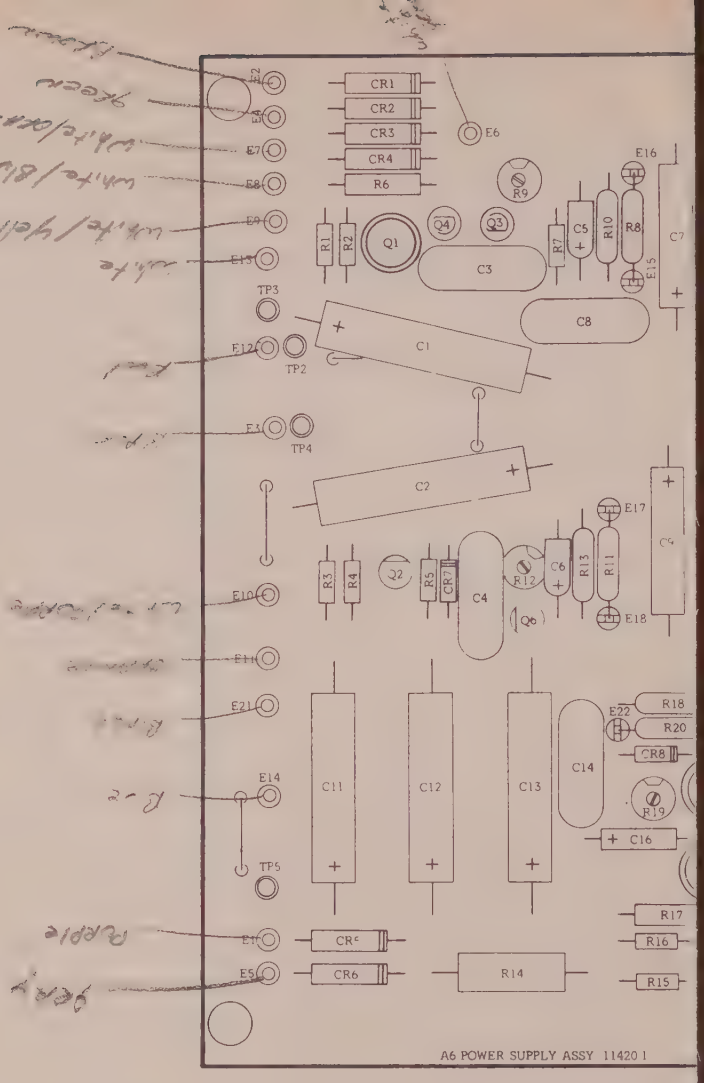
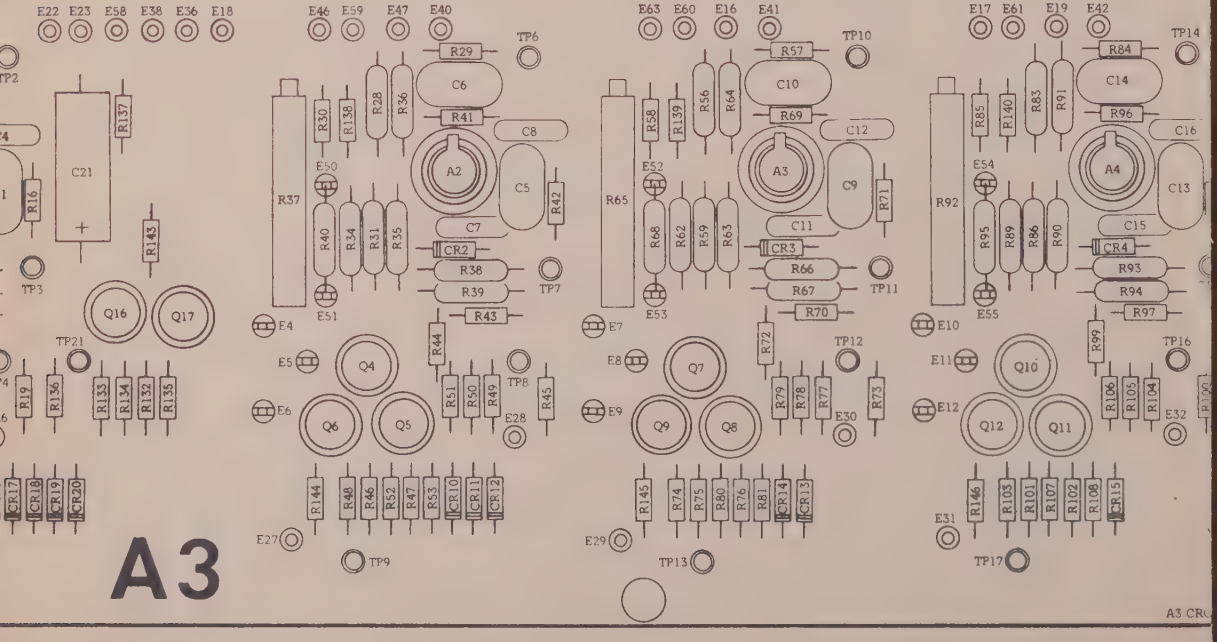
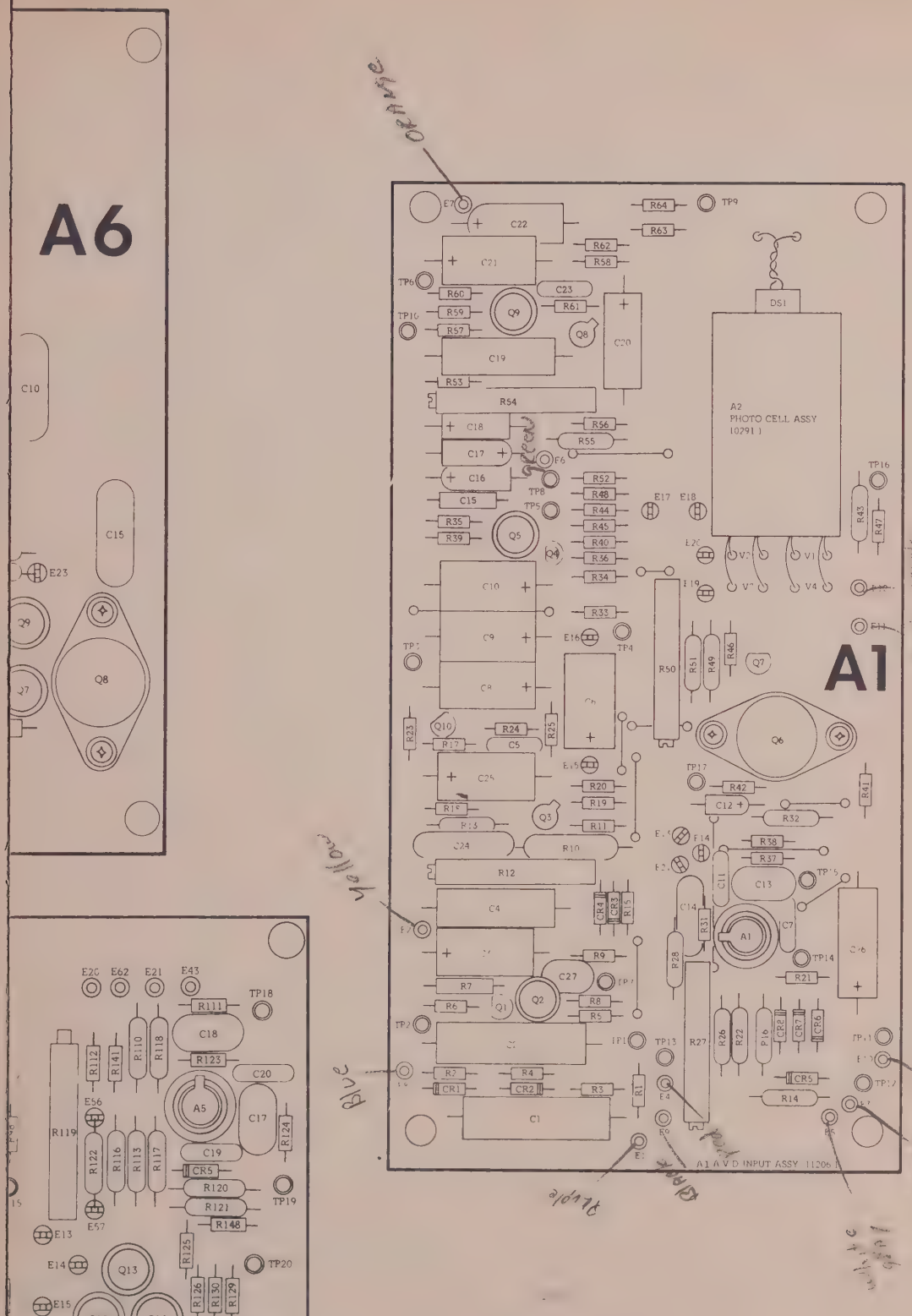
or to any person, except for the purpose delivered.



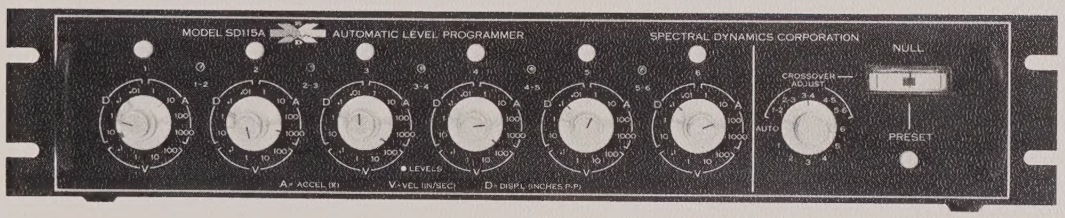




NOTES & REVISIONS: See Sheet 1.

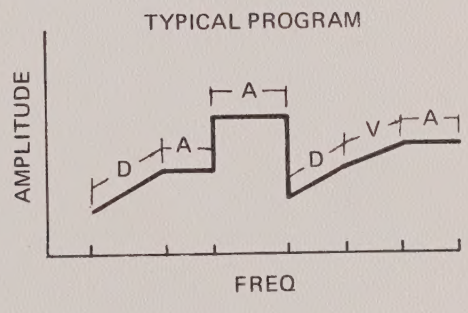
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO	TITLE: SCHEMATIC/COMPONENT LAYOUT— MODEL SD115A AUTOMATIC LEVEL PROGRAMMER	
DRAWN: G Clare	SIZE:	DRAWING NO: 11479
		REV: M
		SHEET 3 OF 3

SD115A AUTOMATIC LEVEL PROGRAMMER

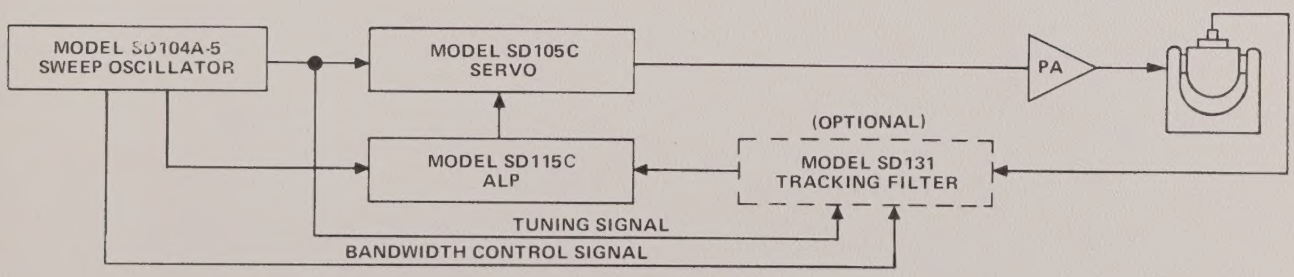


FEATURES

- Six Levels
- Solid-state switching
- Complete preset of test level profile
- Stepped A, V or D capability
- Displacement and velocity control up to 1000 Hz
- Compact (3-1/2" x 19" x 14")



APPLICATION



MULTI-LEVEL
SINE SERVO APPLICATION

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO
POST OFFICE BOX 671, SAN DIEGO, CALIFORNIA 92112
TELEPHONE 714—278-2501 • TWX 910-335-2022

4-73
S-027

GENERAL DESCRIPTION

The Model SD115A Automatic Level Programmer (ALP) was designed specifically for use with the Model SD104A-5 Sweep Oscillator and Model SD105C Amplitude Servo/Monitor. The SD115A ALP provides a means of programming acceleration, velocity or displacement in any of the six available channels and can be used for both stepped A, V or D tests as well as the standard D to A, A to D, V to A, etc. crossover tests.

Relays are not used in the SD115A ALP for performing the crossover functions. A null meter on the front panel of the ALP provides a means of accurately setting crossover points to eliminate "thumps." The crossover frequency is indicated on the SD104A-5 Sweep Oscillator and is automatically programmed in the preset mode using the "NULL" feature.

SPECIFICATIONS*

INPUT

FREQUENCY RANGES . . . . . 5 Hz – 5 kHz

ACCELERATION

Amplitude . . . . . 1 to 1000g full scale
Sensitivity . . . . . 10 mV (peak)/g (peak)
Impedance . . . . . 1 MΩ

SINE WAVE (used in null preset feature)

Amplitude . . . . . Fixed amplitude sine wave from SD104A-5 Sweep Oscillator

DC ∝ LOG FREQUENCY (used for crossover switching)

Amplitude . . . . . 0 to 1 Vdc from SD104A-5 Sweep Oscillator

DC ∝ LIN FREQUENCY (used for internal control signal)

Amplitude . . . . . 0 to 10 Vdc from SD104A-5 Sweep Oscillator

OUTPUT

A-V-D (connects to Accel No. 1 input of SD105C Servo)

Impedance . . . . . <600 Ω

Full Scale Ranges . . . . .

Accel (g) (5–5,000 Hz)	Velocity (in./sec) (5–1,000 Hz)	Displ (in. p-p) (5–1,000 Hz)
1000	100	10
100	10	1
10	1	0.1
1	0.1	0.01

ACCEL (connects to Accel No. 2 input of SD105C Servo)

Amplitude . . . . . 1000, 100, 10 and 1g full scale
Sensitivity . . . . . 10 mV (peak)/g (peak)
Impedance . . . . . <600 Ω

MISCELLANEOUS

INPUT/OUTPUTS . . . . . BNC connectors for signals; some logic and interlocks on multi-pin connector

ACCESSORIES SUPPLIED . . . . . Two manuals, power cord and multi-pin connector

ACCESSORIES AVAILABLE . . . . . Standard interconnect cables for use with SDC Servos

POWER . . . . . 105–125/210–250 Vac, switch-selectable on rear of chassis 50/60 Hz at ≈25W

DIMENSIONS . . . . . Height . . . . . 8,89 cm (3-1/2")
Width . . . 48,3 cm (19") (standard panel)
Depth . . 35,6 cm (14") (w/o connectors)
Shipping Weight . . . . . 4,98 kg (11 lb)

*Specifications subject to change without notice.